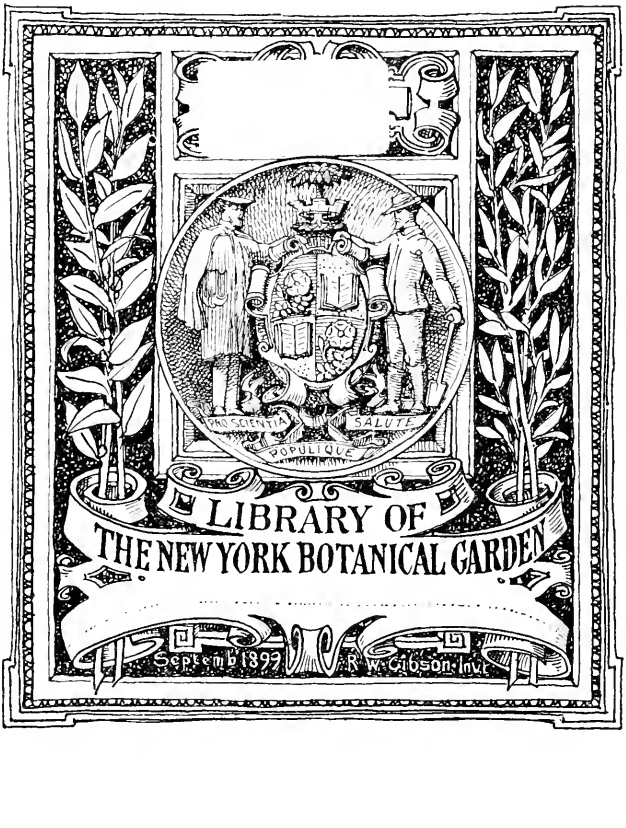
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THE NEW YORK BOTANICAL GARDEN
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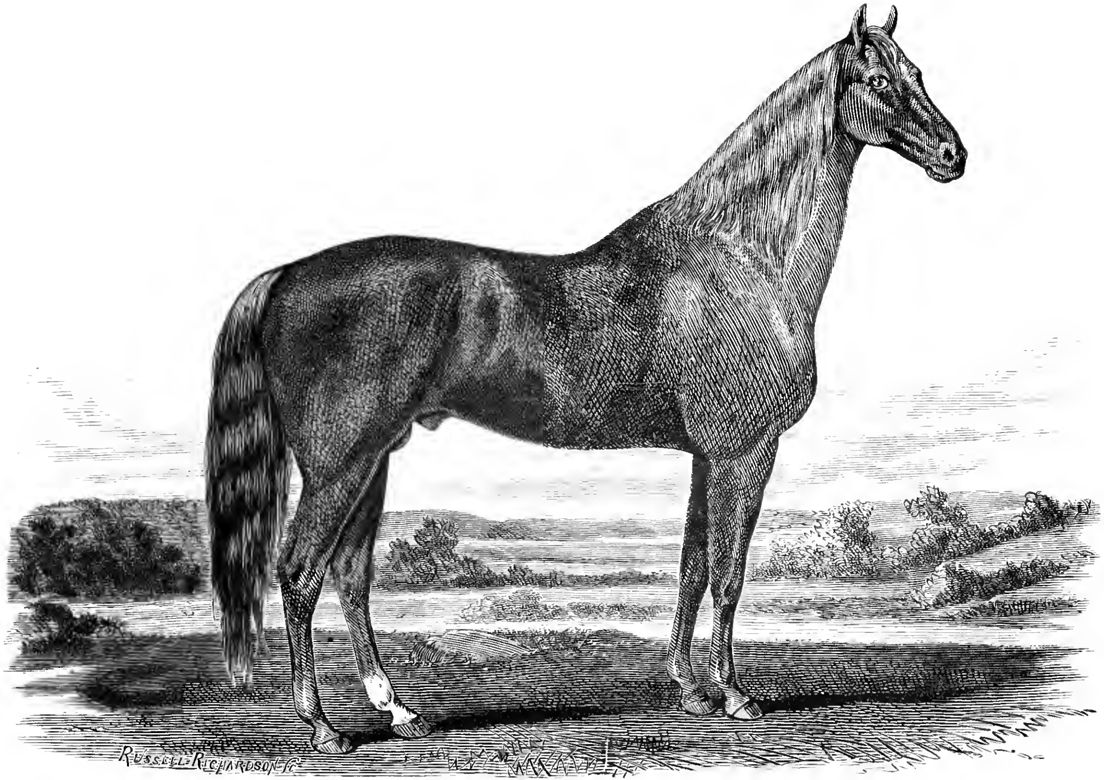


FEARNAUGHT.

PROPERTY OF COL. H. S. RUSSELL, MILTON. — See Preface to Second Part.

TWENTIETH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Massachusetts Board of Agriculture,

WITH AN APPENDIX

CONTAINING

REPORTS OF DELEGATES APPOINTED TO VISIT THE COUNTY EXHIBITIONS,

AND ALSO

RETURNS OF THE FINANCES OF THE AGRICULTURAL SOCIETIES,

FOR

1872.

BOSTON:
WRIGHT & POTTER, STATE PRINTERS,
No. 19 Province Street.
1873.

STATE BOARD OF AGRICULTURE,
1873.

MEMBERS EX OFFICIIS.

HIS EXCELLENCY WILLIAM B. WASHBURN.
HIS HONOR THOMAS TALBOT.
HON. OLIVER WARNER, *Secretary of the Commonwealth.*
WILLIAM S. CLARK, *Pres. Mass. Agricultural College.*

APPOINTED BY THE GOVERNOR AND COUNCIL.

	Term expires.
MARSHALL P. WILDER, *of Boston*,	1874
JAMES F. C. HYDE, *of Newton*,	1875
LOUIS AGASSIZ, *of Cambridge*,	1876

CHOSEN BY THE COUNTY SOCIETIES.

Massachusetts,	CHARLES S. SARGENT, of Brookline,	1874
Essex,	GEORGE B. LORING, of Salem,	1875
Middlesex,	JOHN B. MOORE, of Concord,	1876
Middlesex North,	JONATHAN LADD, of Lowell,	1874
Middlesex South,	JOS. N. STURTEVANT, of So. Framingham,	1875
Worcester,	O. B. HADWEN, of Worcester,	1875
Worcester West,	THOMAS P. ROOT, of Barre,	1875
Worcester North,	EUGENE T. MILES, of Fitchburg,	1875
Worcester North-west,	FARWELL F. FAY, of Athol,	1874
Worcester South,	NEWTON S. HUBBARD, of Brimfield,	1874
Worcester South-east,	WILLIAM KNOWLTON, of Upton,	1876
Hampshire, Franklin and Hampden,	ELNATHAN GRAVES, of Williamsburg,	1876
Hampshire,	LEVI STOCKBRIDGE, of Amherst,	1874
Highland,	JONATHAN McELWAIN, of Middlefield,	1875
Hampden,	HORACE M. SESSIONS, of Wilbraham,	1876
Hampden East,	HORACE P. WAKEFIELD, of Monson,	1876
Union,	ENOS W. BOISE, of Blandford,	1874
Franklin,	THOMAS L. ALLIS, of Conway,	1874
Deerfield Valley,	ROGER H. LEAVITT, of Charlemont,	1875
Berkshire,	ENSIGN H. KELLOGG, of Pittsfield,	1876
Hoosac Valley,	JOHN M. COLE, of Williamstown,	1876
Housatonic,	HENRY S. GOODALE, of Mt. Washington,	1876
Norfolk,	ELIPHALET STONE, of Dedham,	1874
Hingham,	ALBERT FEARING, of Hingham,	1876
Bristol,	AVERY P. SLADE, of Somerset,	1875
Bristol Central,	JOHN A. HAWES, of Fairhaven,	1876
Plymouth,	CHARLES G. DAVIS, of Plymouth,	1875
Marshfield,	GEORGE M. BAKER, of Marshfield,	1876
Barnstable,	S. B. PHINNEY, of Barnstable,	1874
Nantucket,	ANDREW M. MYRICK, of Nantucket,	1875
Martha's Vineyard,	HERMAN VINCENT, of Chilmark,	1874

CHARLES L. FLINT, *Secretary.*

TWENTIETH ANNUAL REPORT

OF THE

SECRETARY

OF THE

BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

It is now twenty years since the Massachusetts State Board of Agriculture was established. Within that time very considerable changes have taken place, not only in the Board itself but in the condition of the agriculture of the Commonwealth. Though the original organization of the Board, consisting of His Excellency the Governor, His Honor the Lieutenant-Governor, and the Secretary of the Commonwealth, *ex officiis*, three members appointed by the Governor and Council, and one member from each of the agricultural societies of the Commonwealth that receives an annual bounty from the State, has been preserved, and is believed, all things considered, to be the wisest and the best that could be devised; the number of agricultural societies receiving the bounty of the State has been doubled by the incorporation of fifteen new organizations in various parts of the Commonwealth. As the act of incorporation carried the right to appoint a member of the Board, the number of members elected by the societies has been doubled also. More than half of those who took an active part in the formation of the Board are now no more.

That the record of this department during the past twenty years of its existence has been alike honorable and useful to the Commonwealth, no one who has any intelligence of its operations and the service it has rendered to the farming community, can, for a moment, entertain a reasonable doubt. It has awakened a wide-spread spirit of inquiry and a desire for improvement never known before; it has collected and distributed a vast body of information which has come to be appreciated and universally sought for, and has issued twenty volumes of Reports, which are everywhere admitted to bear comparison with the best Reports of the kind published in the country.

But if it had done nothing else for the State and the country beside the complete extirpation of that dreadful scourge to agriculture, wherever it exists, the contagious pleuro-pneumonia, it would have paid all the expense of its organization many times over. That the farmers of this Commonwealth are not to-day suffering from the constant dread and the actual visitation of this worst of all forms of contagious diseases among cattle, because the most insidious, is due almost wholly to the existence and persistent efforts of the Board at the time of its outbreak in 1859 and subsequent years. And if it had not been for such efforts, we should now be subjected to a loss of many thousand dollars a year, with no reasonable hope of permanent relief from a tax upon our resources and our patience, the most severe and most difficult to be borne of any that could be imposed upon an agricultural community. The present existence and terrible ravages of this disease in England and other civilized countries where it has become a fixture, causing immense losses every year, and increasing the hazards of stock-farming many fold, is a sufficient proof of the truth of this assertion. And we believe it is not too much to say that England would most gladly pay an amount equal to the whole aggregate cost of our State Board, including all the cost of printing and the bounties to our agricultural societies, for the last twenty years, to purchase exemption from this unmitigated scourge.

The rapid growth of cities and manufacturing villages has led to some change in the chief productions of the farm, and the attention of cultivators has been turned largely to supply the

demands of local markets, in the form of milk, vegetables, small fruits, poultry and eggs, &c.; but this change is not fairly indicated in the statistics of the census of 1870.

The returns of that census wholly omit the production of every description, on more than nine thousand farms of this State, and hence no deductions of any value as to the present condition of our agriculture, or of its condition in 1870 as compared with 1850 or 1860 can be made. The census of 1850, for example, states the number of farms as 34,069; that of 1860, as 35,601; while that of 1870 gives only 26,500,—a difference of 9,101 farms since 1860. Now, apart from the fact that the same causes were operating to increase the number from 1860 to 1870, as from 1850 to 1860, we know that the selectmen and assessors of taxes in each town are far more likely to be correct than the United States marshals, whose jurisdiction extended over many towns, embracing a large area of country. According to the Statistics of Industry of 1865, made up from official returns of the selectmen of each town to the Secretary of the Commonwealth, the number of farms in the State at that date was 46,904, which would leave the number of farms that were overlooked in gathering the census of 1870 still greater than that stated, or more than twenty thousand instead of nine thousand.

But we have a still better means of comparison, so far as a few items are concerned; for the assessors in May, 1870, returned the number of cows taxed in the State as 161,185, and in May, 1871, as 162,782; while the census of 1870, taken at the same time, returns only 114,771,—a discrepancy of very nearly 50,000, which can be accounted for in no other way than on the supposition that a large number of farms were entirely overlooked. Again, the assessors, in 1870, return the number of horses as 107,198, and in 1871, as 112,782; while the United States census of 1870 returns only 41,039. Now if it be said in explanation, that the number given in the census includes only horses kept on farms, it does not help the matter any; for the census states the number of horses *not* on farms as only 45,227,—making the total number in the State, 86,266 only, still leaving a discrepancy of 26,516, on the large number of farms whose statistics are not included in the census, having been entirely overlooked by the marshals. Moreover,

these gross discrepancies run all through the agricultural productions as given in the census returns for this Commonwealth.

The inference, therefore, that our agriculture has been declining during the last ten years, so readily taken up and reiterated by the public press of the country when the census statistics first appeared, is entirely false, and is not justified by the actual facts, as will clearly appear on a more complete analysis of the census and a comparison with the official returns of the several towns, unquestionably the most reliable and trustworthy authority. So far from this, the aggregate value of the farm-production of the State has largely increased, even though a few of the old staple crops may have fallen off, which is by no means certain.

But the most marked and apparent change is to be found in the methods of conducting farm operations, especially in the extensive use of machinery in the place of hand-labor. Twenty years ago there was not a thoroughly efficient mowing-machine in the State, and probably every machine now used has been patented since that time. The practical economy of the mower was not then fully established, nor had the great mechanical obstacles to its use been fully overcome. Few farmers, indeed, had faith that they could be overcome so far as to relieve them from the necessity of the use of the hand-scythe. The work of these machines at some of the great public trials of that day, was hardly admitted to be good enough to be tolerated in comparison with the scythe, while the draught in them all was very great, with a side-draught which was destructive to the team.

But the inventive genius of the country had been stimulated to great activity by the partial success attained, and the rapid growth of this important branch of manufactures, so intimately connected with the prosperity of our agriculture, may be dated about the year 1855. At that time the draught in most of the machines had been materially lessened, though most of them still had a side-draught that was so great as to be very objectionable. But they could not mow fine grass without a constant liability to clog, and none of them could start in the grass without backing to get up speed. But from that date improvements rapidly multiplied. The celebrated

Buckeye, now so generally used in New England, was patented in 1856; the Wood, that has also become very popular, in 1859, and others in quick succession, till, by 1864, there were no less than a hundred and eighty-seven establishments in the country devoted to the manufacture of mowers and reapers, many of them of vast extent, thoroughly built, furnished with abundant power, tools and machinery of every description, and the whole business had come to be wisely systematized, giving employment to sixty thousand men and turning out fifteen millions of dollars worth of machines a year.

At a public trial in 1866, under the auspices of the New York State Agricultural Society, forty-four mowing machines were entered, all but two of which did excellent work, such as would be acceptable to any farmer; and the judges said that the appearance of the whole meadow after it was raked over, was vastly better than the average mowing of the best farmer in the State, though the field itself presented many obstacles. At this trial, too, every machine could stop in the grass and start again without backing to get up speed, and that without any difficulty and without leaving any perceptible ridge to mark where it occurred. And so still later, the trial at the farm of the Massachusetts Agricultural College, where a large number of machines were entered and worked on the field, proved clearly that the mower had become a complete success. The workmanship and mechanical finish of all the machines showed a great improvement over the machines of twenty years ago. They had become more compact, simpler in construction, and lighter. They ran with easier draught, less friction and less noise, and cut the grass well on uneven surfaces.

The mowing machine which, it will be seen, has been, practically, the growth of the last twenty years, was an immeasurable step in advance of the old methods of cutting grass. It comes in at a season when the work of the farm is more than usually laborious, when wages are high, when the weather is often fickle, oppressively hot, or "catchy," and it relieves the severest strain upon the muscles.

The tedder has come into use entirely within the last twenty years, and its practical use on our farms is wholly

due to our own ingenious mechanics; for though the English machine was imported and tried here, it was too heavy and clumsy to commend itself to our farmers and was soon thrown aside. The American Tedder now saves the work of eight or ten men, in the same time, accomplishing a larger amount of work equally well, and at a season when it may be said, emphatically, that time is money.

The horse-rake had been in use for many years, and it was a machine of great value to the farmer; but when the mower came in to shorten the labors of cutting the grass, which the horse-rake stood ready to gather rapidly enough, there was still something wanting to complete and round out, as it were, the new system of haying. The tedder did this. Spreading hay by hand, though not so tedious or so laborious as some other operations, is still slow work, and with the facilities we had for cutting an acre an hour, and for raking several acres in the same time, it still required a large number of hands to cure the grass rapidly enough. The tedder, which does this was, therefore, a most important addition to our previous stock of haying tools, and it is appreciated as such, and regarded as about as indispensable as the mower and the horse-rake.

Though the horse-rake was known and used sixty or seventy years ago in some of its more simple forms, the improvments that have been made in it during the last twenty years, have been so great that they leave little to be desired in a machine for gathering hay. It saves the labor of eight or ten men in the same time, and will rake well from twenty to thirty acres a day, with a single horse and driver, and without over-exertion. It has effected such a saving that it must be regarded as second only in importance to the mower, and almost as essential on the farm as the plough itself.

The horse-fork is another new machine designed to save the severest labor of the farm. Its effectiveness has been completely established, and few new inventions have met with greater popular favor than the horse-pitchfork, and it has come into general use upon most large farms.

Nor has the improvement in other implements of the farm been less marked. The plough has been adapted to a greater

variety of soils. Its draught has been made easier, and in workmanship, finish and durability, great progress has been made. The harrow has been improved to a still greater extent, and some new forms have been invented, like the Shares', and the Nishwitz, that are an incalculable advance over the harrow of twenty years ago, since they enable us to mellow and pulverize the surface after the plough, without disturbing or tearing up the old sod. Planters and seed-sowers, drills and cultivators,—in fact a long list of the smaller tools,—have either been wholly introduced within that time or have undergone such improvements as to make them much more efficient.

The cheese-factory system has grown up entirely within twenty years, and in the middle and western parts of the State, beyond the line of the milk supply for the city of Boston, it has proved to be a great step in advance upon the former methods of economizing the milk on a large number of farms, relieving the farmer's household of the care and drudgery attendant upon the manufacture of cheese in private dairies, securing a better method of manipulation and thus commanding a higher and more remunerative price. The concentration of this business at some central and conveniently accessible point, presents all the advantages of division of labor, so favorable to success in all industrial pursuits. It secures far greater uniformity of product, while the application of a higher degree of skill and scientific knowledge has resulted in a higher average standard of quality, and hence enhanced the value of our cheese and given it a reputation as an important article of export.

The plan of operations adopted by the Board for the first time in 1864, contemplating a regular public meeting in different parts of the State once a year, at which lectures and discussions should be interspersed, has met with so much favor among the people that it has been continued ever since, and is believed to have been productive of much good. These meetings have generally been well attended, though better in strictly rural districts than in larger towns. The lectures and discussions have constituted a leading and important feature in the reports, where they have been widely read. The last country meeting was held at Barre, and not-

withstanding the fact, that it was aside from the great lines of railway, and consequently more inaccessible than many other localities, the attendance was good throughout, and the interest kept up to the close.

PUBLIC MEETING OF THE BOARD,

AT BARRE.

The annual meeting of the State Board of Agriculture was held at Barre, in the Town Hall, on Tuesday, Wednesday and Thursday, Dec. 3d, 4th and 5th.

The Board was called to order at 2 o'clock on Tuesday, by Thos. P. Root, Esq., of Barre, chairman of the committee on meetings, who delivered the following

ADDRESS OF WELCOME.

Gentlemen of the Board of Agriculture :

It gives me great pleasure to welcome you to this meeting.

We have looked forward to this event with increased interest, ever since it was decided that this should be the place where you would meet the country farmers, face to face, and discuss the various ways by which we turn field and forest, hillside and meadow, rough in nature as they may be, into the best fertility, or how we shall best manage all the varied interests of the farm, whether it be the manipulation of the soil, the interest in our domestic animals, the raising of grain, vegetables or fruit.

We prize your coming the more, because of the effort and self-sacrifice you have made, in turning aside from any of the great thoroughfares of travel, and consenting to ride in a country conveyance over a country road, some of you ten and some twenty miles to reach us.

At your meeting last winter in Boston, when you were called upon to decide where should be the place of your country gathering, the question arose, What are the facilities for reaching Barre? The past and present members of the Board from this district stated to you, that in all probability you could reach us by rail. The event has proved that the

members from Worcester West were false prophets, and I might say the same of every man on the line of the Ware River Railroad.

Your advent among us, has not been heralded by the steam-whistle, or the rolling engine. You came here by means of that domesticated power which we rejoice to see again in our streets, hailed as a sick friend from his couch. Who shall again say the world moves by steam? Did you ever prize the horse so much as you do to-day? Then I beg you will forgive my friend and myself for having encouraged you to believe that you would have a railroad ride to our very doors, and be thankful that you have had another opportunity of seeing our great dependence upon that power which, when he takes himself to his sick stall, blocks all the channels of trade and commerce, and imperils cities filled with palatial warehouses and all the elements of life in their highest state.

The people of Barre have had a due appreciation of the debt which she, as well as all the agriculturists of the State, owe to those who were the first projectors of the Board of Agriculture, and to all those earnest men who have been its faithful and efficient members, who have labored constantly to promote and improve the agricultural industry of the State. Composed as it is mostly of delegates from each of the societies, it has brought together the various methods of husbandry in all its different localities, for the discussion of its members, twice each year. These discussions, and the valuable reports upon all the important branches of farming, have reached us through your printed Transactions from year to year; they have cheered our hearts with an aspiration for a higher and more remunerative system, and have guided our hands in shaping for ourselves better ways and means for accomplishing our purposes; but it was reserved for us, till the present time, to meet you face to face and receive that mental stimulus and attrition of mind upon mind without which but little general advancement has ever been made in any of the great pursuits of life in which a people, as a whole, are carried to a higher level, and advance onward in rapid strides.

While some of the sciences and arts seem to have climbed to the topmost round of eminence, and from their outlook can

lay down exact rules for guidance, agricultural knowledge is still in the background.

It has been said that the educational, religious and political aspects of the world, in its higher progress, have been like great waves that sink and swell and still roll onward.

This hardly holds true in our department, unless we except some instances in the earlier centuries. No sudden upheaval has marked her gain, or thrown it forward so that times and dates can mark such an era.

But we trust, gentlemen, that the time has come when a flood of light is to fall on the hills and valleys of Worcester West. Coming down from the hills of Berkshire,—yes, beyond,—Herkimer's brightest light is here. And, turning in the other directions, we see some of the greatest lights of modern science,—men who are spending their lives in the actual field of practical experience, as well as in the laboratory of chemical analysis and all the intricate paths of scientific research; and whose names are known and honored, not only in our country, but throughout the world. We gladly welcome you to our hall of discussion; we welcome you to our farm-houses and homes.

Some of you are strangers, and know nothing, personally, of our people, our land, our habits. We are strictly an agricultural community and have but little mechanical or manufacturing interests. These interests have not grown up here, and probably are not more extensive than twenty years ago; but it is not for the want of natural facilities, to be found in the abundant water-power in our streams, but our distance from easy communication with the channels of trade has shut out capitalists, and we thus have been left as a strictly rural people, and that without any home market at our door.

Whatever disadvantages the manufacturer would have labored under, we, as farm-producers, have felt with great pressure.

You have been disappointed in your facilities for reaching us, and we regret, as well as you, your disappointment; but it has its compensation. You know the obstacles we have to contend with, to keep up in rank with other sections of the State in improvement and development; you understand, as nothing but experience can teach you, what it is to live so

far from railroad in winter, and how much it must cost to transfer our produce and our wants. With all these odds against us, it is a matter of surprise that our population has maintained its numbers to such an extent. You may desire to know how, with all these disadvantages, we have got on so well as we have.

My first explanation is, in our *resolution*. I can speak without liability to the charge of egotism,—as I am of comparatively recent residence,—when I say that our farmers, seeing the difficulty before them, *determined* to *succeed;* and so they have. They have had no spare capital to expend in show, and no fancy farms to excite an unhealthy emulation, and so they have, each one for himself, gone ahead with industry and economy. Another reason for success may be found in the peculiar adaptation which this section of the State has for agricultural purposes. Our soil may be considered the best, except the alluvial—as found in the Connecticut Valley—consisting of clay loam. The sand and loam it contains, give it porosity and heat, and the clay gives it an absorbing and retaining power; making it (except the alluvial) the best which nature has bestowed, for raising spring grains, market gardening, or fruits; and what is of more importance, a soil in which grasses, under favorable atmospheric influence, grow through the whole season, when they once start in the spring.

Geographically, you have met on this occasion in the *heart* of the Commonwealth. The people believe (and I doubt not the accuracy of their conception) that the brains of the State tend to the cities, and a large part of its activities, its arms and legs, to the manufacturing and mechanical centres. But we must remember that out of the heart are the many springs of action; it is the producing power from whence, and on which depend the activity of brain and limb; and it is for the brain to infuse into the functions of the heart, so that this part shall be, as well as the thronged cities, dominated and controlled by its intelligent action. The farmer needs all the wisdom he can get from the geologist, the chemist, the mineralogist, the botanist, the zoologist and mechanic, with the financial sagacity of the successful business man.

It was our privilege a few weeks since to welcome to our

doors the secretary of the board of education and his efficient corps of able professors, with a large attendance of teachers, met together as they did for a four days' instruction in the duties and labors of practical teachers. They entered at once with spirit and zest into all the plans and purposes that were presented for their improvement and future usefulness. And when they left, they had the consciousness of having all contributed their share to the general good, and had received a double portion for all their time and attention; and they also had the benediction of this whole community, from every household where each had been a welcome guest, and from every heart and soul that had been expanded with higher and clearer conceptions of intellectual and educational improvement.

Happy results always follow well-directed efforts. If it had been your privilege, in one or two weeks after this meeting, to have visited any of the schools in this vicinity, you would have found the seed that had been sown in this hall springing up and starting into life. It mattered not whether it was in the primary or high school, or away yonder in the white school-house on the hill-side, the brown house at the forks of the road, or the old red one by the woods, the indelible impress of Professors Dickinson and Walton, Munroe and Mason, had been made; the seed had been sown, and as true as nature to herself, it breaks its encasement, shoots into active life and being, and bears fruit.

But you, gentlemen, may ask why I break into another department of our state economy? It is simply because it is the best and nearest at hand of any illustration I can give you for your encouragement at this meeting. The channel through which so much has come in one department can be equally successful in ours for the general good.

We invite and welcome you here for your good and the community you represent, as well as for *our* special benefit; the communication of facts and information must be reciprocal. We do not welcome you here simply to the rich entertainment provided for in the rich course of lectures. Our distinguished professors are not to bear *all* the burden of this labor, and it is not for them to reap the harvest; their granaries are running over now.

Then, gentlemen, we welcome you all to a part in these *discussions;* to this fraternal gathering; to this rare opportunity for a more extensive acquaintance with the agriculturists of the State. Be free with each other; make yourselves at home; gather what facts you can for your intelligent action in the future, and scatter them from Franklin to Middlesex, from Berkshire to Essex; from the Hoosac Mountains to the islands on the coast.

But I must not extend these remarks; the importance of the subject which is soon to come before you, and the brief time for its discussion forbid it. But, lest these brief words of mine,—appointed as I have been, as one of your number to hold out the hand of welcome greeting,—lest these should be inadequate to convey to you the feelings of this whole community, I am happy to be able to invite your attention to a member of the committee of arrangements on the part of the citizens of Barre,—Dr. Allen,—a physician by profession, a farmer by choice. In the hour of our country's greatest need, he emulated his profession in the camp and hospital, and now he labors with ardent enthusiasm in his country's greatest industry.

ADDRESS OF DR. CHARLES G. ALLEN.

Gentlemen of the Board of Agriculture:—I hope you will not infer from the very formal manner in which my friend has introduced me, that I am to detain you with any set speech. My associates, members of the committee appointed by the town of Barre, to co-operate with my friend, Mr. Root, in making arrangements for your comfort and pleasure during the sessions of the Board, have delegated to me the very pleasant duty of welcoming you in behalf of the citizens of Barre. We are glad to meet you here to-day, and I assure you that as citizens and farmers, we appreciate the efforts you have made to come into our midst, and we hope that we may make your stay here so pleasant, that at some future time, when the rails shall have been laid and the iron horse can bring you, we may meet you here again.

But my duty is to say to our friends from the adjoining towns, and to any strangers who may have come among us

for the first time, that the citizens of Barre bid them a hearty welcome; that we hope they will make our homes their homes while they may remain with us; that we wish you to come among us and make our acquaintance, and we will make all the efforts we can to make your acquaintance. And, lest some might be overlooked in the great interest we have in your discussions, we have appointed a sub-committee, consisting of Messrs. A. H. Holland, J. H. Goodrich, J. F. Snow and James F. Davis, whose duty it will be to find accommodations for any one who may not have them, and I hope that any gentlemen so situated will feel at liberty to give their names to the members of this committee, and we shall take great pleasure in welcoming you to our homes.

But, as has been said by the chairman, you have come here for another purpose than to listen to us; and I will not detain you longer, except to repeat that we welcome you here very heartily, and we hope especially that the friends from the adjoining towns will come to our homes; that they will not go away until the session is closed. We want you to stay with us night and day; not come to-day and go home at night, and, perhaps, not come to-morrow. We have taken special pains to circulate notices of this meeting in the adjoining towns, and we wish our friends to come here and remain with us until the final adjournment of the Board.

The chairman then introduced the Hon. Harris Lewis, of Herkimer County, New York, who was received with hearty applause, and proceeded to address the convention, on the subject announced in the programme.

DAIRY HUSBANDRY.

BY HON. HARRIS LEWIS.

To the members of the State Board of Agriculture of this Commonwealth, and the ladies and gentlemen present, I will tender, at this time, my thanks for the cordial greeting extended to me on my appearance. I come here before you under many disadvantages; first, being a working farmer, a dairyman who has milked his seven cows in the morning up to yesterday, and labored in the field every day in prepar-

ing for the winter, I have been unable to make that preparation which I should have been glad to have made, to meet so intelligent a body of men and women as I now see before me. I labor, also, under the disadvantage of having, in your able Secretary, a partial friend, who has overrated my ability to instruct or to interest you. I also labor under the disadvantage of being "the light of Herkimer County." If I am "the light of Herkimer County," surely there must be a good deal of darkness in Herkimer. But, my friends, with the hearty welcome which has been given me, I am glad to clasp hands with you, not "across the bloody chasm," but across the intervening space between Barre and Herkimer.

I feel somewhat at home with you, and I hope your chairman will not prove a *Root* out of dry ground. I also hope that many young Roots will spring up from the original Root, which shall replace him in your estimation, when he is gone.

Six weeks ago, if any man had said that we were more dependent upon the horse than we were upon our fellow-man to move the wheels of this commercial world, he would have been pronounced an idiot; but that fact has been established within six weeks. It is self-evident to every man here. Yet we have been able to substitute for the horse, man-power to some extent. I have seen men dragging express-wagons in the streets of Utica, the city nearest my home. I have seen a man on a mail-route, twenty-four miles in length, carrying the mail-bag on his back. I have seen the slow, yet strong and patient ox, substituted in the place of the horse, and the untiring steam-power brought to fill his place. Yet with all these helps we have come to the conclusion that we have been more dependent upon the horse than we were aware of. Now, gentlemen, should another like epidemic strike the dairy cow, and destroy her usefulness, only for a time, how would it affect us? What should we bring forward to take her place? We are dependent upon her for milk, for butter, for cheese, and directly or indirectly, for veal, for beef, for liver. What other animal, I say, could we bring in, unless it be the goat, to fill her place? Well, if the cow holds so important a position in our domestic arrangements, it will be well for us, on this occasion, to give her a passing

notice; and let us, in the first place, speak of her summer food.

I propose, in the little I say to you, to speak of the cow's summer food, her winter food, and her care; but being unaccustomed to public speaking, I am very apt to say, when I get up, things which I never thought of saying; and sometimes reporters make me say things which I never dreamed of saying; and I often forget everything that I thought I would say; and I am very apt to say things in an exceedingly awkward manner; but if, through my oddity, in any way I can produce any impression, so that you will remember what I have said, whether it be wise or foolish, my mission here to Barre will be accomplished. But if I go away and you forget all I have said, why, I shall certainly be sorry.

I think the food best adapted for the dairy cow is grass,—grass first, grass last, and grass all the while; and I have no doubt you will all agree with me. If you will look into the internal arrangements of the cow, you will come to the conclusion that the cow was made to eat grass, or else grass was made for the cow to eat. You may have it either way. If you take either position, I will not dispute you. Now, the question may sometimes arise in the mind of the dairyman, "How is she to get grass?" Well, that is the question. How can you provide for the cow a sufficient quantity of good, nutritious grass? My notion is, that a cow should be turned out to grass as early in the spring as the weather becomes suitable for her to be out, and as soon as the ground becomes sufficiently settled and dry. I know that I shall, in what I have to say, differ from a great many men here, and some women, too; but I say, turn your cow out early, as soon as the weather and the pastures are suitable. By so doing she will nip the first grasses that start, and what dairyman is there among you who has not different kinds of grasses growing in his pastures, that, if they are allowed to grow to a considerable height before they are cropped off, will grow up and go to seed, and the cow will never touch them? but if cropped when small, when young and tender, they will be cropped throughout the summer, and your pasture will carry more stock, and carry it better; and cows will produce more milk throughout the summer if you turn them in early in

the spring than if you keep your stock yarded up until the middle of May. Why, gentlemen, I think that the man who will keep his cows confined in his yard or his stable until the middle of May ought to go to jail. I won't say that he ought to go to Ludlow-street jail, where our friend Victoria is, but to some decent sort of a jail. It is advantageous to the cow as well as to the pasture. You turn a cow out as soon as the grass starts in the spring, and then continue to feed her hay as you did through the winter, as long as she will eat it, and roots as long as she desires them, and you make the change so gradual from hay to grass that the cow hardly realizes it, or is in any way affected by it. I tell you, gentlemen, it is a bad practice to shut a cow up in the barn until she can get a full feeding of fresh and nutritious grass, and take her off in the morning from her hay and change her right on to a pasture. Although not all the ill effects may be discovered at first, in a few months your cow may have an attack of garget, and the cause and effect have been so far removed from each other by intervening time that you fail to trace the connection between them; yet it certainly exists. The milk-producing organs are terribly overtaxed, and the cow feels it when she takes hold afterwards. There is less danger, however, in turning a herd of dairy cows into a fresh pasture that have been wintered on grass than a herd of dairy cows that have been wintered on hay. And in speaking of grass and hay here, I design to convey the idea that a cow ought to be wintered on grass as well as summered on grass. Let me explain myself: cut your meadow while it is grass; do not wait until it is changed into that woody fibre that we call hay. Cut your meadows while they are grass, you know, and you have dry grass to winter your cows on. I make this explanation, also, that you may not be muddled about anything I say afterwards.

Your pastures probably fail to produce a sufficient amount of grass for your cows in August, sometimes in July. Is that the case here in Barre?

SEVERAL VOICES. Oftentimes.

MR. HARRIS. You probably sow corn to feed them. I am not much of an advocate for corn, gentlemen. I tried corn five years and concluded I would let my corn go to grass.

(Laughter.) I have adopted, after twenty years, this practice. I have a piece of meadow that I top-dress occasionally. One of my neighbors said once that I buried it in manure; but I never covered it so but what the grass peeped up through. I have one piece, however, that I have top-dressed quite heavily, from which I have cut nineteen crops in ten years. I cut this very early. It is a meadow of mixed grasses; there are probably thirty or forty different kinds of grass in it. I cut this, I say, very early. If my cattle need it at the time I cut it, I feed it to them; if they do not, I lay it by to feed to them the next spring. I can cut that again by the first of August, and this I use instead of feeding fodder corn, or sowed corn, and, allowing the cows to judge, I think it is better than corn; and I believe a cow knows fully as well what she likes to eat as her owner. I believe she knows what will suit her wants full as well as your Secretary here, Mr. Flint. Well, this bridges over that space. I would bridge it over with grass.

It may be asked, perhaps, what kind of grasses are best for a pasture. The best one kind, I saw occasionally peeping up through the snow of your pastures as I was on the way to Barre. It is known as June grass. Now, gentlemen, do not be surprised, or say I ought to go into a lunatic asylum, because I say June grass is your best pasture grass. I will say something stronger than that. No section of country under heaven, north of the equator, ever succeeded in the dairy business without June grass. You may travel through Herkimer County, "where all is light," according to friend Root, and ask one dairyman after another, and ninety out of every hundred—I was going to say ninety-nine, and I guess I will,—will say white-clover is the best pasture grass. I have no doubt you may go through this section of the country and ask your dairymen here what is the best pasture grass, and they will say white-clover. Gentlemen, June grass is what has made Herkimer County what it is; it is what has made Delaware, Scoharie, Chenango, Ulster and Orange counties what they are. It is the base of their butter and cheese. It is the foundation upon which their milk rests, and it is the best grass you ever saw in Barre for pasture. Now, gentlemen, do not do as our Herkimer County farmers—our *wise* Her-

kimer farmers—attempt to do; root it out and destroy it, root and branch, as unfit to be grown. Why, it is what in Kentucky makes the beef and those enormous Shorthorn cattle. It is the Kentucky blue-grass. You cannot grow it here, neither can we in Herkimer, to that degree of perfection to which it grows in the limestone soil of Kentucky in a climate peculiarly adapted to its growth; but it is Kentucky blue-grass nevertheless. Now, gentlemen, I hope you will think more of it than you ever did before. It will stand your droughts better than any other grass you can name. It will make two distinct growths here each year. Take my word for it, gentlemen, white-clover is your poorest pasture grass; although not strictly a grass, we rank it under that name. If any dairyman present has a herd of cows running on a white-clover pasture, that do not shrink in their milk when it gets up so that they can get a good bite of it, when it gets in blossom, let him rise up; I want to see that man. Nobody gets up. (Laughter.) Gentlemen, it is the poorest of all your pasture grasses, and yet I love to see it grow; but when my white-clover gets to a good size, my cows shrink in spite of fate, unless I turn them off. I can pasture them on a white-clover pasture and have them shrink, and I can turn them in where there is not a particle of it and have them gain on the shorter feed. You can do the same thing if you will try it.

If the food of a cow affects the quality of the milk,—which the Germans deny,—June grass produces the best milk in the world. I am not fully prepared either to accept or reject the doctrine laid down by some of the professors at Hohenheim. I have fed cows that were out to pasture, that had all the grass they could eat, even if they sat up nights to eat; I have fed them all kinds of food, in addition, without being able to increase the quantity or improve the quality of the milk produced. Hence I say that grass is the food for the cow; and I say, in connection with it, that corn is unnatural food for the cow. You may feed any of our grains, ground fine,—as they always should be to be fed,—to a cow or any animal you are about to slaughter, and you will find that it passes through the first stomach, by the second, through the third, on to the fourth, and a part of it even be-

yond that, within the space of fifteen minutes. That is, you may feed an ox or a cow, fifteen minutes before you want to slaughter the animal, on fine-ground grain, and you will find it in the fourth stomach or beyond it. There is nothing in the stomach to hold it, and, unless you mix it with other food, so as to retain it, it passes off and but a very small portion of it is digested.

There is another way, gentlemen, by which you may supply your cows during the summer with grass. Take an acre of land convenient to your barn. If it requires under-draining, under-drain it; make a thorough job of it; if it requires subsoiling, subsoil it. Prepare it so as to seed it down by the last of August with orchard grass; say at the rate of three bushels to the acre. You may put in a little Timothy seed if you desire; you may put in a little of the small clover, if you want it, and, after the next season, you can get four cuttings of about two feet each, if you have that land rich when you seed it. You can get your first cutting before May goes out; you can get your second before June goes, and if you want it to splice out your pasture food, use it; if not, cure it and lay it away for hay. You can get your third cutting often by the time you would get your sowed corn ready to feed. Now, gentlemen, which is the best food,—grass two feet high, to feed your cows with when you need it, or corn that is not up? Why, the grass!

Now let me dodge a little. No man will succeed in any business, whatever, unless he attends to the minutiæ of that business, and attends to it at the right time and in the proper manner. If you do not supply your cows with food at the time when they require it, you will make a partial failure in spite of fate. Now remember my proposition; you must attend to all the minutiæ of the business in which you are engaged, at the right time and in the proper manner. The right time to supply a cow with food, additional to that which she obtains from her pasture, is when she wants it. You must not allow that cow to shrink in her mess in midsummer, or lose in her condition; you must keep up her condition and her flow of milk, and that you cannot do, gentlemen, with sowed corn. Sowed corn will do but one of those things

at any time. If you maintain the condition of the cow, you do it at a sacrifice of the flow of milk. If you maintain the flow of milk, the cow will lose in condition. Grass will do both; corn will do one and not both.

If I had a soil every way adapted to its growth, my first choice of a soiling plant to use in connection with the pasture, would be lucern. Cattle eat lucern with very great relish. It will grow more than one hundred inches in a year, on a good soil that is suited to its requirements. It wants a deep, loose, mellow soil, and if the soil is open, so that the roots can run down about eight feet to reach water, it is a delightful spot for lucern to dwell in. You can prepare a piece of land for this, and splice out your pasture so as to carry your cow through with an abundant supply of good grass. But if you have neither, if you have no piece that you can sow to orchard grass for this purpose, nor lucern, take a piece of common meadow, with mixed grasses, and do as I indicated. Cut the first crop very early, and then you can get a second cutting when you want it to soil your cows.

Perhaps I have said as much as I need to in regard to the summer food of the cow. I have said as much and perhaps more than you will remember. I will close, then, in regard to pastures, by merely making one suggestion, and that is this:—when you seed a piece of land down for pasture, sow it with all kinds of grass-seed that will grow. It will be better to sow ten kinds that will not grow, than to omit one kind that will grow. And by all means sow Kentucky blue-grass, as one of the grasses, and you will get Barre June grass from it. Never omit this, and never omit, gentlemen, when you stock and seed down a piece of land for pasture, to sow every kind of grass indigenous to your soil. They are the most reliable grasses in any spot under heaven, that I ever saw,—the grasses that are native to your soil, the indigenous grasses,—I do not care whether they grow an inch high or twelve feet.

There is one practice in regard to pasturing that I fear you and I differ about, to which perhaps I may allude, catching the wink of a friend's eye over yonder, with whom I had a conversation, and found that he and I disagreed. He likes to change his cows from one pasture to another. Well, it has long been said that "a change of pasture makes fat calves."

He may have got his opinion from that old adage, but however he got it, or however tenaciously he hangs to it, he is wrong, gentlemen. No dairyman in Barre, or anywhere else, can afford to have more than one pasture, for one herd of cows, and for these reasons. You change a cow from pasture to pasture, and you make her uneasy, discontented. The first thing she will do will be to range over the field, ascertain its area, and the weak spots in the fence; how much food she has, and how good it is. That is before she commences to eat. Why, gentlemen, this is as demoralizing to the cow, as free-loveism is to mankind. (Laughter and applause.) Now you will remember that. The cow ranges over the field looking for feed better than it contains, and more of it, as the other animal ranges over all creation to find its affinity. (Laughter.) Both range over and range back, dissatisfied with their present condition. The one never finds what she looks for, and the other never finds its affinity. Our friend Victoria has found a good place, whether she has found her affinity or not. (Laughter and applause.)

Now, gentlemen, there is another reason why you cannot afford to maintain so many pastures. Your fences cost a deal of money, or a deal of stone and labor. While I was on my way up here, I was struck with the smallness of your fields, and I have set you down as one of the most industrious people I have ever been among. Why, you have got such heaps of stone piled, by which you have divided one field from another, that I came to the conclusion that you were either anxious to get your stone out of the way, or else to have small fields, and a good many of them. Gentlemen, sink your stone out of the way, if you cannot do better with them. Bury them out of sight, as we do any other nuisance, and arrange your farms so as to have just two fields, one pasture and one meadow; and let that meadow embrace the land you cultivate; let your mowing lands embrace the lands you cultivate. I will give you credit, certainly, for industry, for perseverance. I would trust you to get a living on a bare rock, or a steep mountain side. Why, put a Herkimer-county dairyman upon some of the dairy farms I have passed through, and if he had ambition enough left at the close of the year, he would take Uncle Horace's advice, and "go West." Perhaps this

allusion is out of place just now, and I beg your pardon for making it.

Now I will say a few words in regard to the winter food of the dairy cow. I have already occupied as much time as I intended to, and perhaps it would look better if I sat down, but I can say that twenty years ago, I adopted in my winter arrangements for feeding and growing dairy stock, what is known as the Barre system, feeding twice a day. Now, as to food. I commence cutting my grass before it gets headed out. By this means, I get the last cutting in the barn by the time it ought to be cut. I know the rule is to leave it all until all should be in the barn. Here, gentlemen, we make a very great mistake. When grass is in blossom, it contains all the nutriment, all the elements for the production of milk, muscle, fat and butter, that it ever does, or ever can contain; and if you allow it to stand until after the seed commences to form, it loses in value rapidly. It soon changes all of its nutritious elements from the stalk to the seed, and the stalk becomes worthless woody fibre. By all means, cut your grass for your winter food while it is grass. Let a field of Timothy stand until the last leaf has departed, the seed shelled from the head, and the stalk standing alone in its glory, and it is not half as good as oat-straw,—not half. Cut your grass early, dry all the water out of it, and you have for winter feeding, dried grass. For twenty-five years I experimented on a small scale to ascertain what I could best use to feed in connection with this dried grass, to restore back to the grass its original succulence, — as nearly as possible what it contained while growing. I tried to do it at the least expense, and I have come to the conclusion that, on my place, with the little I know about farming, I can do it cheapest and best with mangold-wurtzel. By feeding mangold-wurtzels to a cow each day, in connection with my dried grass, I turn January into June, to every intent and purpose. The cow has her grass restored to its original quality and succulence, the very food that nature designed she should have all the year round. There is no other way that I have tried, by which I can do this so cheaply, so effectually, so perfectly, as I can with mangold-wurtzel. I never have raised a crop that cost me over seven cents and four mills per bushel, and I have grown crops.

that only cost me five cents and four mills per bushel. I feed these in connection with the last cut hay. At that time, the hay last cut has more woody fibre than that first cut, and the mangold-wurtzel has more water, and you see how they sandwich together. They come in just as naturally as whiskey runs down a toper's throat. (Laughter.) There is the greatest amount of water in the mangold, when I need the most in the hay I am feeding; and as I come to the first cut hay, the dried grass, — virtually, grass dried, — I have less water in the mangolds. Every man can do this as easily as he can turn his hand over, or just as easily as he can put the hay he cuts to-morrow on top of the hay he cuts to-day. He puts it in, in exactly the reverse order in which he feeds it out, and in which he wants to feed his roots in connection with it.

Now, gentlemen, if any of you have devised any better winter keep for the cow, I would like to hear it, because I came here to learn, not to instruct. I do not expect to tell a single man here anything new, but I expect to stir you up, "by way of remembrance," about some things whereof perhaps you have forgotten.

Now, in regard to the care of the cow. The cow, as we have her in this latitude, is far removed from her native pastures, and we have put her in an artificial position. The cow likes warmth, and I hold that the cow should be kept in a temperature at from sixty to seventy in her stable, when we can do so. But supply her with an abundance of pure air, and with plenty of the light of heaven, without which no animal or even vegetable life can be maintained in health. Milking is a part of the care of a cow, and a very important part. I hold that a cow should be milked regularly; that is, if milked twice a day, the day should be divided into two equal parts. If milked three times a day, it should be divided into three equal parts as nearly as may be. I have always milked twice a day. We commence milking at the same hour, night and morning; we milk by the clock. The cows are divided among the milkers according to their ability to milk; and each milker milks the same cow, first, second and so on, at every milking; so that each cow is milked twelve hours before she is milked again, and twelve hours after she has been milked. For instance, suppose we take an hour.

and a half to do our milking, three hours in the day, and I milk Sallie first in the morning, this morning, and milk her last to-night, what is the effect? Why, according to Dabol,—that was the arithmetic I studied,—one milking would be nine hours from the other; and the next, if I reversed it again, would be fifteen hours from the other. You see how easily we can milk hap-hazard, as well as we can do other things hap-hazard, and how easy it is to do the thing right. Again, a cow never should be milked any faster than will be agreeable to her. A cow should never be milked so fast as to give her pain, or make her uneasy. The idea that a cow must be milked very rapidly, is all gammon; it is all in your eye. I admit you may make more froth on the milk by milking rapidly, but you will not get so much milk. If you milk so fast as to give the cow pain, you will lose in the milk and you will lose in the cream. Milk just so fast as you can milk without giving the cow pain, or making her uneasy; but when you put your hands to the teats, milk continuously until you get through.

Another point is important to you dairymen who deliver milk at the cheese factory, for I have observed that you have cheese-factories in this neighborhood. I believe the dairymen in Herkimer County, have become indifferent, careless, in regard to the milk they carry to the factories. I think they reason in this way:—"If a little lump of dirt gets into my milk, you know it all goes in together, and it will be so little in mine that it won't affect the amount much; and suppose the milk *is* a little dirty, won't it bring clean money?" I tell you, gentlemen, this won't do. In our milking operations we must be neat, careful; absolute cleanliness is the rule we ought to adopt. I have seen men milk when the filth from their hands dripped into the pail. Now the drippings from the filthy hands of a filthy milker, milking a filthy cow, must be pretty near the perfection of filth. (Laughter.) I hold that whoever milks in this way never ought to milk any more milk than he wants to drink himself. Let others milk the rest, so that it may be decent for the customers to whom we offer it, or its products.

One other point and I will relieve you. The cow should be carded daily, while stabled. This is a point almost univer-

sally neglected, yet perhaps it is as important as any other part of her care. The cow should be treated with uniform kindness and gentleness. If our Maker has impressed any one thing more uniformly upon the whole universe than another, it is that like begets like; that like produces like, in regard to our conduct towards each other, and our treatment of one another; and it extends beyond the human to the whole animal kingdom. Like produces like. Show me that boy or that girl who receives a kick or a cuff, when within reach of his or her parents, for every little irregularity, and I will assure you that that boy or girl will have a sad end. Show me that boy or girl who always receives a kind word and an affectionate look from the parent, and I will show you a girl or a boy who will always be better for it. Show me that wife who is encouraged in her domestic labors, instead of having fault found with her by her husband, and she will always be a better woman. Show me that cow that is kindly treated; that is caressed instead of being kicked, and I will show you a gentle, confiding animal. But when I visit a dairyman, and about the first thing I come in contact with, is a savage dog, who wants a piece of veal out of the calf of my leg (laughter), and then, if I go within reach of his cow, she shrinks all down into a wrinkle, if she is tied up, for fear of being touched, or, if loose, flies away from me, it is about all I want to know of that man's character. Gentlemen, he misuses his wife and his children, as well as his cattle. He ought to have lived a bachelor, upon some lonely island all his days, and never had a wife, or a chick, or a cow to abuse. Gentlemen, kindness begets kindness the world over; love begets love; hatred begets hatred. It is true in the brute creation as well as in the nobler race of animals, and whoever brutally treats an animal as noble and useful as the horse or the cow, must, I think, have originated as Darwin says he did. (Laughter and applause.)

The Chairman. This question of Dairy Husbandry is now open for general discussion. I hope gentlemen will take part freely in discussing this, the most important subject that can be brought before this session. There are many gentlemen present, who are thoroughly posted on this question, and I trust no time will be lost.

Mr. HUBBARD, of Brimfield. There were a few points brought out in the course of the lecture to which we have listened, in regard to which, the views of the speaker differed from what I suppose to be the general opinion of the farming community. One was, that the food a cow eats makes no difference in the quality of the milk. I call to mind an instance which occurred in connection with the cheese-factory with which I am connected. There was one dairy that brought a quality of milk that was very poor. This milk was tested, day after day, until it was decided that it was adulterated. The course taken to ascertain whether the milk was adulterated or not, was to go to the place at the time of milking and get a can of the milk, which was brought to the factory; and then the next morning, when the milk came in, the two were tested to see whether the quality was the same. It was found to be the same, and the question came up, what makes this milk so different in quality from the milk of other dairies? The only conclusion they came to was that the food of those cows was of a very poor quality.

For a long term of years I sent milk to Boston. There were certain dairies that were preferred over others, because the quality of the milk was better; and the difference in the quality of the milk was attributed to the feed. Those people who feed their cows to get the largest quantity of milk, usually feed wheat middlings or shorts, and that increases the flow of the milk, but not the quality of the milk. Another individual feeds corn-meal with oats; and that improves the quality of the milk, but does not increase the quantity.

I believe the condition of the animal makes some difference as to the quality of the milk. If the animal is not in good condition, the quality of the milk is not so good as it is when the animal is in good condition.

There is one other point to which I wish to allude, and that is, that the cows should have but one pasture. Now we may know some things just as well as anybody else, and still not know very many things. I know individuals who keep one pasture for their cows, and I know of others who keep more than one. My own cows have had, for several years, three pastures regularly,—having so many days for this one, so many days for that, and so many for the other; somewhat

in proportion to the size of the pastures and the amount of food produced. One pasture produces a large quantity of what we call June grass; another pasture has a large quantity of clover, although some part of it has a little June-grass; the other is in a similar condition. I have noticed that when the cows go into the pasture that has only June grass, and occupy it so many days, they fall off in their milk. Why is it that they fall off in their milk when they go into that pasture, as they do not fall off when they go into another pasture that possesses, not clover altogether, but different grasses,—the other having almost entirely June grass? I have always attributed it to the quality of the food that the cow ate. It is possible that there was more in quantity in the other place, and that might account for the difference; but I always supposed that it was the difference in the quality of the food. I can hardly think differently in regard to the matter.

These are things which have come under my own observation in regard to the quality and quantity of milk produced from different pastures.

Mr. Lewis. I see that my friend misunderstood me. My position was, that I had been unable, with anything I could feed to my cows, to improve the quality or increase the quantity of the milk, when giving them all the good grass they wanted. Cows half-starved don't give as good milk as those that have enough to eat; and I apprehend that my friend's June grass had got too big and his cows would not eat it. If he will keep his June grass short, and turn his cows into that, if he does not get more milk than he does from clover, I will give him my hat and go home bareheaded. (Laughter.)

Dr. Sturtevant, of Framingham. I should like to ask Mr. Lewis the average yield, per cow, of his dairy.

Mr. Lewis. I made cheese for twenty-two years, and my average for the time was a fraction over 500 pounds of cheese per cow, including heifers and all. I have never milked over forty.. I commenced the dairy business with fourteen cows, and as fast as I could find neighbors owning the adjoining land fools enough to trust me for another piece of land, I ran in debt for it, and increased my dairy. I have never milked over forty cows; my average, I should think, has been about thirty-seven.

Dr. Sturtevant. I refer to the milk.

Mr. Lewis. I have never measured it. I have often weighed it. We can weigh milk better than we can measure it, unless we wait until the froth subsides.

Dr. Sturtevant. With reference to the effect of food upon milk, I can state a fact which will show the uncertainty of it, but which does not prove anything. Under the same feed, and under the same circumstances, the same cow gave, one day, nine and a half per cent. of cream, and another day, eighteen per cent. of cream.

Mr. Lewis. I can tell a bigger story than that. (Laughter.) Although a cheese maker, principally, I have made butter enough to know what white-oak cheese is sometimes, but I have taken a good deal of pains to test the value of my milk that I have worked into cheese. I have per cent. glasses for the purpose, and I have found a cow whose uniform percentage of cream was 18 per cent. reduced to six, in twelve hours,—not from any change of food, but from a little excitement. You gentlemen who make butter, be careful to adopt my advice and always treat your cow gently and kindly; never get her excited, because every ounce of excitement will take from her milk one per cent. of cream. I have known a cow abused by a furious, brutal milker, and the percentage of her cream went down one-half. It is astonishing what an effect excitement has on the percentage of cream in the milk that a cow produces. You will be astonished if you will make the test, and make it carefully. I have known a cow, excited from natural causes, to drop in her percentage of cream in her milk from fourteen to six per cent. in twelve hours. So I would again repeat, whoever abuses his cow knocks out of his milk a large percentage of the cream.

Dr. Sturtevant, of Framingham. Mr. Flint invited me to make a few statements in regard to the yield of dairy cows, and I have prepared some figures, which I will read.

With reference to the average yield of milk in Massachusetts (because we wish to get a basis by which we can ascertain the comparative yield of milk), I find, on looking over the "Agriculture of Massachusetts," a record of 76 different experiments, carried on by 19 different people, in Worcester County, during a series of years, by which it appears that it

took, on the average, 20.9 lbs. of milk to make a pound of butter. In 1864, the statistics of 425 cheese factories in the State of New York gave the proportion of milk to the pound of cheese as 9.11.

In the statements I make, I reduce butter and cheese to the milk valuation by allowing twenty-five pounds of milk for a pound of butter, and nine and a half pounds of milk for a pound of cheese, which will certainly be fair.

I find, then, that according to the census of Massachusetts, in 1865, the amount of milk sold from each cow was 691 quarts. In nine towns in the Hoosac Valley, with 7,480 cows, the average yield, in 1865, was 1,179 quarts per cow. The average premium dairy of seven cows in Essex County, is reported, in 1865, to have given about 1,750 quarts. Another dairy of nine cows, in Danvers, in 1856, is reported to have given about 2,000 quarts per cow. Another gentleman from Sudbury, who feeds daily five quarts of a mixture of rye, corn and cotton-seed meal to his herd, reports a sale of 2,274 quarts per cow for one year. Another premium herd of six grade Durhams reports 2,460 quarts a year.

The only returns of yearly yields of single cows that I find in the Massachusetts Reports are four native cows, four owners, 3,189 quarts per cow, and forty-four native cows, in four herds, 2,160 quarts per cow;—that is the average of the herd, counting all as in milk.

These are the records of premium cows and competing herds, with but one exception, and must manifestly be far above the average.

I now go outside of the State of Massachusetts, having exhausted all the definite facts that I can find in our Reports, to the State of New York. I will not give the particulars from which I draw my conclusions; I will state it as probable, and have you take it upon trust, that the average yield of dairy cows in the State of New York, is not far from 1,300 quarts. The average of the best dairies in the State, 1,800 quarts. The possible average which can be attained by the best farmers, with their best herds, 2,300 quarts. Here, you will notice, there is a common difference of 500 quarts, between common, best and superior dairies. I speak not of the yield of individual cows, but of the average of a herd of cows.

In 1865, I and my brothers purchased "Waushakum Farm," in Framingham, Middlesex Co., and procured the very best native cows we could find, continually disposing of poor cows and replacing them by better, and breeding in stock.

In 1866, with an average of 35.7 cows, we produced 2,160 quarts per cow, on an average.

In 1867, with an average of 36.3 cows, the average yield per cow was 2,229 quarts.

In 1868, with an average of 27.4 cows, the average yield per cow was 1,850 quarts.

The average yield for the three years, from thirty-three cows, was 2,079 quarts per cow.

We then imported some Ayrshire cows, and these, with other Ayrshires purchased in this country, comprised our herd for the next three years. As we were now breeding, we had to change our system of feed. A system which would allow us to send a cow to the butcher when injured, would never answer with a breeding herd of valuable animals.

In 1870, average number of cows, 19.8; average yield per cow, 2,616 qts.
1871, " " " 18.7; " " " 2,300 "
1872, probable " " 13 probable " " 2,853 "
Probable average number of cows for 3 years, 17.
Probable average yield of milk per cow, 2,588 quarts.

I say "probable," because the year is not yet ended. It cannot be far from correct, however.

The years 1870 and 1871, it will be remembered, were years of extreme drought, and very unfavorable to pastures.

As a matter of interest, I will state here, that Mr. Miles, of Fitchburg, who makes a very candid and apparently fair record of his herd of 9.3 cows for three years, gives his average as 2,587 quarts per cow per year.

I shall now represent the facts I have deduced in another form:

	Possible Average.	Average of best Dairies.	Common Average.
Natives, ...	2,300 quarts.	1,800 quarts.	1,300 quarts.
Ayrshires, ...	3,000 "	2,500 "	2,000 "

Here is a common difference of 700 quarts in each class; and if my figures are correct (and I have taken every fact I could obtain, and excluded none), this sum, 700 quarts, may well represent the breed difference of the Ayrshire and native cattle. Consequently, any farmer who exchanges his natives for Ayrshires of the same rank among Ayrshires as his natives are among natives, increases, by this change, the average annual yield of his dairy, per cow, 700 quarts. The milk farmer who is selling his milk at four cents a quart, can increase his annual yield by at least $28 per cow, by replacing natives by Ayrshires of equal grade.

It is probable that these same results will apply in a determinable ratio between grade Ayrshires and natives; but I have not yet collected sufficient facts to warrant a definite statement of my own ideas of the value of grade animals.

When, through the exertions of the friends of agriculture, and the workers, sufficient facts are published, I shall reserve the right to change these figures. The *breed difference* is there, and is *great.* Thus much our present knowledge enables us to state; and according to my present figures, which include every fact I have been able to collect, 700 quarts is this breed difference.

I should not lay so much stress upon the records of Waushakum Farm, did I not know that they are perfectly accurate. Similar judgment was exercised in selecting both natives and Ayrshires; similar care, similar ideas of feed, modified only by circumstances, and similar recording of facts; we have here the conditions of a true comparison of breeds. The milk has been weighed daily, from each cow on this farm; and I have the recorded weights, with the food each day or month, and other notes of interest, preserved for future reference.

As a curious fact, let me add, that of all the cows whose yield for the year I can find given in my Massachusetts Report (I have not the Reports for 1858 and 1862), the average of the four premium native cows is 3,189 quarts; the average of the three Ayrshire crosses per year is 4,673 quarts; the extremes among the native cows are 2,692 quarts, and 3,826 quarts; among the Ayrshire grades, 3,700 quarts, and 6,048 quarts; the average of the best native or grade

herd of six cows, selected from a herd of twenty, for one year, was 2,462 quarts; the average of Waushakun herd of Ayrshires, six selected animals, for one year, was 3,123 quarts. Here, also, we have about 700 quarts, representing the breed difference between Ayrshires and natives.

Mr. Wetherell. I would like to have Dr. Sturtevant tell us whether the Ayrshires he selected were not all superior cows, collected from the various States and from Canada; and whether those would represent a fair average of the Ayrshires generally, as compared with the average on the other side; whether the natives which he has compared with the Ayrshires, were the best natives that could be selected, as the Ayrshires were the best that could be found.

Dr. Sturtevant. I will state what our practice has been. In selecting any cows, we select the best we can find among a great many individuals, and in selecting our native cows we had our choice among tens of thousands: we had the whole country to choose from; and we selected the very best, in our judgment, that we could find, and paid the largest prices for them; and at the time when good milch cows were selling for from fifty to sixty dollars, we had a standing offer, well known to all the farmers in the region, of one hundred and twenty-five dollars for any cow that would milk 26 quarts a day. We purchased cows under that plan, and we claim, therefore, that while our comparison of the best cows in each breed is certainly fair, it is yet not quite fair, because in selecting the natives, we had tens of thousands to select from; and in selecting the Ayrshires, we had only a few thousands in Ayrshire, and a thousand or so in this country to select from. So it is a fair comparison, because it takes the best Ayrshire cows and the best native cows and compares them together. We could very easily compare the average Ayrshire cow and the average native cow, provided we had the statistics which would give us the average in each case; but it is fair to presume that in the cases presented to our agricultural fairs, by farmers, each farmer presented the best cow he had, and thought she was a very superior cow; and in taking these statements, and the cases presented in the Reports as the best individual cases, and in taking the Ayrshires we have taken,—which in our judgment

were well selected,—we have the elements for determining the difference; and this difference must be the grade difference.

Mr. WETHERELL. Did not the gentleman select prize animals from Scotland, from Canada, and from Northern New York? and if so, whether the same pains were taken, on the other hand, to obtain the same quality of high grades? that is the point.

Dr. STURTEVANT. I have referred to the published statement of Mr. Miles, of Fitchburg, who has not an imported animal in his herd. He gives the yield of his cows for three years past, and, strange as it may seem, his average for three years comes within one quart of our average for three years,—2,587 quarts in his case, and 2,588 quarts in ours. We have given the average for three years, of a breeding herd of Ayrshire cows, while the native cows were not a breeding herd, but a herd fed for milk, when we have had no young stock in the barn; raised none from them. The conditions are perfectly even for comparison.

Mr. PERRY, of Worcester. What our friend Lewis said, in regard to cows having early feed in the pastures, was all very well; but it seemed to me he went on afterwards to contradict himself. He says, by all means have your cows in one pasture. Now, my experience is, that if you turn your cows out early, as he recommends, into one pasture for a few days, then change them into a second and into a third, they in that way get the feed as it comes tender from the ground; whereas, if you turn them into a large pasture, they select the sweetest portions of that pasture, and neglect other portions which are not sweet; and they grow up and become useless for feed. I contend that if a man has forty acres of pasture, and has four pastures, he can keep twenty-five per cent. more stock, and get twenty-five per cent. more milk than if he kept the whole forty acres in one pasture. Then, again, Mr. Lewis spoke in regard to winter food. He seemed to lay a great deal of stress on grass; and grass is good in its place. He rejects the views that all farmers have entertained, I think, in regard to the clover crop. I have been in the dairy business for the last fifteen or twenty years, and I think I can speak from experience. I think there is nothing

equal to clover, to give a full flow of milk, and I have never heard that it was not of good quality.

The gentleman remarks that he doesn't think that the kind of food makes any difference in the quality of the milk; but I think it makes a great difference; because, if I feed turnips to my cows, my customers will tell me at once that I have been feeding turnips; they taste them immediately in the milk. Then, again, Mr. Lewis don't provide for any change of food. I think "variety is the spice of life," and it is just as true with regard to stock, as it is with regard to men. Animals want variety and a change of food constantly, just as we do.

Mr. Lewis. Let us carry out this beautiful theory a little further, and make our pastures so that we can change our cows twice a day. Why not? The greater the number of pastures, according to the gentleman's theory, the better the cows will do. Isn't my position true?

Mr. Perry. No, sir. I should say, to a certain extent: that is, have four or six pastures.

Mr. Lewis. "Four or six!" There is no charm in either of those numbers. If you had said *seven*, you would have hit my superstitious bump.

Mr. Perry. I would say more than one; I would say less than eight.

Mr. Lewis. I declare, I cannot for my life see the point. The idea that it is not best for a cow to have her food uniformly from one day to another, is something passing strange to me. I think that if a cow is fed with uniform food,—has her food as good to-day as it was yesterday, and as good yesterday as it was the day before, and just the same,—that cow's product will be greater, her satisfaction will be greater, her health will be more perfect, and she will be much better contented and satisfied in one pasture, where her food is uniform from day to day, than she will to lead this rambling, roving life from one pasture to another. Does not every man know, who is acquainted with the habits of a cow, that the oftener you change the field of that cow, the more dissatisfied she is, the more she is inclined to roam and find weak spots in the fence! She is not satisfied with the enclosure in which she is placed until she has looked it all over, and found some place to get out

and escape into another, if there is another. Now, my cows, while roaming in the same pasture from day to day, from week to week, from month to month, are perfectly satisfied with their condition. They don't seek to reach out into my neighbors' fields at all. I learned this by accident, just as I have learned whatever little I know, by accident. My neighbor east of me is a good, clever neighbor, but he belongs to that class of persons to whom the boy belonged who said that he "didn't care whether school kept or not." He is a slow and easy fellow. He never puts his cows up, and never takes them out from his pasture from one year to another. I divided my pasture into two fields, when I commenced dairying, and this man, this slip-shod, hap-hazard dairyman right by my side, beat me out of sight with his one pasture, where he turned on his herd early in the season. His pasture would carry, acre for acre, more stock than mine, and I began to look at it. My farm was in the best condition. It was better situated, it had a better sort of grass, the grass grew better, and I had on the average ten times as much spare feed as he had, and yet he could beat me. As I say, I began to look at it, and I wiped out my division fence, and that improved it; I turned out my cows as early in the spring as would answer to turn them out, and there I made a big improvement; and I have come up to him and beat him sky-high ever since.

Mr. A. H. Ward, of Bridgewater. It seems to me possible to explain the difference. One gentleman says that clover diminishes the quantity of milk from the cow, and another gentleman says that clover increases the quantity. Both gentlemen are undoubtedly correct. In this part of the country, as far as I know, it has always been understood that clover increased the milk, and was actually the best food that could be given. The gentleman from Herkimer refers to June grass. Now, it is known that in Kentucky, in the blue-grass region there, not only is the quantity of milk from the cows large, but the animals are of large size. The grass grows well, and one reason of that is, that it is a limestone region, and there is a large amount of phosphate in the soil, furnishing bone to the animal and richness to the grass, to put on the fat or increase the quantity of milk. We know that when

cattle are put to pasture in the spring, if they can find an old bone in the field, they will go to work and gnaw it. That seemed to me to indicate that phosphates, in some form, were needed by our animals to enable them to grow bone, and it seemed to me that as there was a large amount of phosphates in the milk and bone, they must require phosphates in some form or other. Therefore I tried, some years ago, to demonstrate that point to my own satisfaction by giving my cows ground bone; but if ground bone were given them with all the animal matter in it, it was repulsive to the animals, and it was difficult to make them eat it. If you give them burnt bones, you get the bones in a fine powder, and it is a very good way to give it; but I thought I discovered a better way by burning bone in the same way that you would burn wood to make charcoal. When burned in that way, it contains all the phosphate of lime; and while giving that to my cows, I estimated the quantity which they would require per day, and I think it was two and one-half ounces. I gave it to one of my cows, and she immediately began to decrease in milk. The difference was quite marked. Now, it is well known that clover contains a larger amount of phosphate than the grasses, and it strikes me if the gentleman's cows decreased in milk, it must have been on account of the amount of phosphate in the clover; that is my impression, without much reflection.

I have tried another thing to increase the quantity of milk that the phosphate of lime decreased. I gave one of my cows, with the phosphate, a pound of molasses a day. The increase in the quantity of milk was slight, but it increased it about what the other cow, which had only the bone, fell off, making it just about an average between the two. I tried another experiment. One cow was fed with molasses and this bone charcoal; another was fed the molasses alone. From October 10th to October 20th, the cows having ample pasturage all the time, the cow fed on molasses and bone charcoal gained three pounds of milk, the cow fed with one pint of molasses per day, with her usual food, gained five pounds of milk. A third cow, going to pasture and having the usual food, gave eighteen pounds of milk, which was increased one pound during that time. I then changed the feed, and gave the one that had molasses alone, molasses and bone charcoal. The one

that had molasses and bone charcoal, I gave molasses alone. The other one, that had had nothing but the ordinary feed, I began to feed with molasses. I kept this up from October 26th to November 20th. During that time, the cow that had molasses and bone charcoal, now being fed on molasses, had fallen off four pounds. The one fed with molasses and bone charcoal, formerly fed with molasses alone, fell off three pounds. The one having nothing but the ordinary feed at first, but now having molasses, gained a pound. At that time, November 20th, I ran out of molasses and was out four days, and the cow that was giving then, on molasses, nineteen pounds of milk a day, fell off to eighteen. The other, that was giving thirty-three pounds, fell off to thirty. The other, that was giving thirty pounds, fell off to twenty-seven. My entire stock of molasses having gone, I thought I would try a new experiment. There is about three per cent. of oil in Indian meal, and I attributed the milk-giving qualities of that meal to the oil there was in it, and I thought if I could get my cows to eat an oil that comes from the coast of Africa, called palm-oil, it would have the same effect. This oil is made from a nut, and the natives use it as we do butter here, but when it gets to this country, it becomes rancid, and is not so pleasant. I thought if I could mix that palm-oil with molasses and make a kind of sauce of it, they might eat it. I accordingly made a mixture of a pint of molasses, two ounces of bone charcoal, and half a pound of palm-oil, gave it to one cow daily, and she gained five pounds of milk a day, from November 24th to November 29th. Showing that, by combining all the elements which are necessary to the food of a cow, the phosphate, the oil and the sugar, that cow gained five pounds of milk a day. I asked my man who did the milking, and also my girls who took care of the milk, if they could see any difference in the quality of that milk, and they said the effect was plainly to be seen in the color of the cream and in the quantity. My cows were always healthy cows, and they were giving very rich milk, but at this season of the year, of course, they do not give milk so highly colored as at other times.

I have been experimenting in regard to coloring milk. I have been giving what is called ground turmeric. This is

a pungent substance that comes from the East Indies, and is made into a curry, and used largely in that way. It gives a very yellow color. I was giving my cows about a teaspoonful of that turmeric a day, to give increased color to the milk; and I found that had a beneficial effect. Then I was going, by reason of that experiment, still further. Knowing that if animals are fed with madder root, which is a sweet substance used for dyeing, but at the same time very nutritious, it will color their bones red, a query arose in my mind whether, if I fed that turmeric to my cows, and wanted to sell them for beef, the butcher would not find the bones yellow and want to know what the matter was; and it might discredit the beef. So I told my man to shut up six chickens in different coops. I wanted to try the effect of the turmeric root on them; thinking I might reason by analogy, as to its effect on animals.

I think we have an explanation of the effect of clover in decreasing the milk, in the fact that when cows which have not had sufficient phosphate in their previous food, have clover fed to them, the phosphate carries the nourishment to the bone and decrease the milk.

While I am up, I will say that a number of years ago, having some interests near Utica, I went to one of the cheese-factories, feeling some interest in those things. I was running a woollen mill at that time, and I bought a great deal of cheese-oil, to use on the wheel, instead of lard-oil, and the other oils that had formerly been used. I know it occurred to me at that time, that if I were manufacturing cheese, I would devise some way to keep that butter in the cheese, and make it better. As Mr. Lewis is from that section, I thought it might be interesting to him and to the farmers here who are interested in cheese making, to inquire whether it would not be better to keep the whey-butter in the cheese, than to have it lost; for I know that one gallon of that went as far as a gallon of lard or olive-oil in oiling machinery.

Prof. Agassiz. Among the experiments concerning the food of cows, there is one which nature has been trying in Switzerland, on a very large scale, and which may not be known to the farmers here. There are two very distinct districts in Switzerland, geologically: the portions north and

northwest of the Jura, which are limestone, the westerly part of Switzerland, called the limestone region; and the more easterly and southerly parts, which are granitic, and abound in mica slate, and all those kinds of rocks into which limestone enters only in a small proportion. Throughout the limestone regions the cattle have a large, very strong and solid skeleton; while in the granitic region, of course, the cattle are smaller. You thus see how necessary a supply of lime is (for it is not phosphate of lime there, it is merely limestone) to the building up of the frame of these animals. Of course, where the materials for building the frame are wanting, there must be a change in the condition of the creature.

Mr. Wetherell. I will mention a fact which probably others have seen: that the milk producers in the neighborhood of Chicago, feed their cows in winter largely on cured clover-hay, and it was reported—with what truth I cannot say—that dried clover-hay was pronounced the best forage for making milk that farmers had; that they could get more milk from a given amount of forage of cured clover than from any other dried verdure.

Mr. Lewis. That is true.

Mr. Flint. I should like to ask Mr. Lewis to state a little more definitely the details of his method of feeding. In Mr. Ellsworth's very valuable essay upon his method of feeding, which appeared in the report of the proceedings of the Board last year, he states quite carefully his process of feeding. Mr. Lewis, as I understand him, says that he feeds twice a day; but he did not go quite so carefully into his method of feeding, as Mr. Ellsworth did last year. I think every dairy farmer here would be very glad to have him state a little more clearly and definitely his exact method of feeding; whether he simply gives all the food at once, or whether he pursues a method somewhat similar to that of Mr. Ellsworth.

Mr. Lewis. I don't know as I stated my method. It is simply this: I differ a little from Mr. Ellsworth. You will remember, those of you who heard his statement, or who have read the report, that he stated that he fed poor fodder first, followed it up with better feed, and finished with the best he

had, at the same feeding. Now, my practice is to feed the best feed first to the cow, and finish up with the poor after she has eaten all the good she desires. I tell you, gentlemen, if you attempt to defraud a cow a little, you cheat yourselves abominably. Although you may consider the cow a mere machine for the manufacture of milk, she will not make much milk out of stuff that contains little or no nutriment; and if a straw-cutter is good for anything under heaven, it is good to cut up poor fodder to use as bedding—if you have nothing better. Cut your grass, gentlemen, at such a time that your cow will be her own cutter, and sell your frying, stewing and boiling machines. When grass is cut in its proper stage of growth, the cow is prepared to masticate it, to digest it and assimilate it with perfect ease, and she will do it. After she has had a full feeding of the very best hay,—mixed hay,—she will lie down and half close her eyes; she will masticate it very slowly, and present the very picture of contentment and happiness.

I have switched off a little, but I will say now, that instead of adopting Mr. Ellsworth's system, I would feed the cow all the first-rate food she desired to eat first, and then I would give her poorer food. Then I would water her, and twelve hours after, as nearly as may be, I would feed her again all the good early-grass she desired to eat. I would give her a feeding of roots in the morning, but not let her out to water. The cow is a creature of habit, like her owner, and she may be brought to one feeding a day, or two, or three, or five. I have dropped down to two feedings a day, believing it better for the cow. I believe she masticates her food better to have two feedings a day, the time being divided as nearly equal as possible. I think she assimilates her food better, and digests it better, when she has but two feedings. I had a neighbor living in the northern part of the town, a good dairyman, who owned a meadow and barn about a mile and a half from his dwelling. He practised for a good many years driving his herd, as soon as he drove them out, up to that barn, to feed out the hay that was grown on that meadow. He was an old gentleman, and he would take out his horse in the morning, after breakfast, go up and feed his cows all the hay they would eat, let them out to drink, clean the stable, and return them,

get on his horse and ride home, and his cows were not visited again till the next morning. I confess to you, gentlemen, after examining that herd, I was surprised. I found that herd in just as good condition as a herd fed three times a day. I had practised, up to that time, for five years, feeding three times a day. I dropped down to two feedings a day, and have followed it ever since for twenty years.

I would say, in regard to stabling cows, that I prefer stanchions, not from any feeling of humanity to the cow, of course, for I regard that as the only barbarous practice I have retained in regard to dairying. I think stanchions are hard and uncomfortable things for a cow, but still, a cow will waste less feed in a stanchion, she will keep cleaner, and they are more convenient to use; that is my apology for using them; and if slanted a foot forward at the top, the cow will get at her food very easily.

I bed my cows with sawdust of dry bass-wood. I use about a hundred bushels a week, and bed all my animals with it. It aids in keeping them clean, it absorbs all the liquid, it breaks up the tenacity of the cow manure so that I can handle it just as easily as I can handle horse manure, and I find that the sawdust, as it decays, is no set-back on a clay soil.

In regard to salting, I differ from Mr. Ellsworth. I found it a very good practice to mix with my salt, sulphur, at the rate of half a pint of sulphur to a peck of salt, and a pint of wood ashes to a peck of salt; and, most of the time, I have fed bone meal, nearly a pint to a peck of salt. I will say that the bone meal I have fed was cleared of all mucilage. It is bones that have been boiled, every part and particle of the meat taken off, and prepared on purpose for cattle feed. I mix this bone meal, salt, sulphur and wood ashes, and keep it by my cows continually, where they have access to it every time they go out of the stable. I find this is the best way to salt cows, for the reason that if they have it always before them, they eat it when they want it, and are never forced to eat it when they don't want it, as they are sometimes when it is fed with their food. Then they will never take too much, they know just how much they need, and will eat so much and no more.

In regard to watering cows, although I let my cows out

twice a day (I let them out the second time just before feeding), I do it more for the purpose of cleaning and dusting the stable, than I do for giving them an opportunity to drink more than once a day. Feeding roots, however, has the same effect. I guess they will drink a good deal less water when being fed roots. I find it, also, a good practice to feed regularly. I believe that a cow will do much better on five pounds of hay fed at regular intervals, than she will with an extra five pounds fed hap-hazard, just when convenient. The cow, as I said before, is a creature of habit, like her owner, although she never forms so many bad habits as her owner; yet she is like a child, and becomes impatient at delay when the regular time for feeding or milking passes by. She should be fed by the clock; regularly fed, in quantities such as she requires.

Now, if you adopt the Barre system of feeding, adopt the method which I suggest. Instead of offering your poorest and most worthless fodder first, feed it last; and all that the cow leaves of this—after she has eaten all she will of the good fodder—will do for bedding; but don't attempt to bamboozle the cow and cheat yourselves.

Mr. J. T. Ellsworth, of Barre. We should understand from what the gentleman from Herkimer has said, that he has but one kind of food, and that is early grass; and early grass that he calls hay, cut a little later, and mangold-wurtzel. That is very desirable. If I go West, I want to go to just that section where they have that kind of feed to give their cows; but it is not so here. I think we shall make up our minds, after hearing his remarks, that "all is not gold that glitters." We have all kinds of coarser fodder to work up somehow, and particularly this year. If we commenced our grass early, we didn't make good early-grass of it; some of it was pretty poor hay, pretty badly-washed hay. We have more or less straw of all kinds; and corn fodder, and hay that was cut late, and washed hay, which we wish to work up in our dairy stock; for we have mostly dairy stock. We cannot compete in raising steers with the stock raisers of Kentucky. I could demonstrate the results of my method of feeding, if any gentlemen would go to my barn at the present time. We had pretty hard seasons for grass this

year and last year. I sowed a large piece of millet last spring; but the storms came and beat it down, and it rusted and was a pretty poor crop, I thought; nevertheless, I made to save it, and out at the present time my cows are eating one foddering of that rusty, poor millet. They will take it at the first foddering with a pretty good appetite. I follow that millet with some hay,—not my best, early-cut hay, but hay that was cut a little later,—and they will take that very well; and I follow that with some rowen. That has been their feed this week and last week; and they eat that poor millet, and not the best hay, and rowen, all clean, every straw of it, and will go and drink and appear to be hearty; appear to be contented, and are full. Well, sir, reverse that, if you please, and, judging from our own appetites, would a cow eat the rowen, then the hay and then the millet? I think not. So far as watering twice a day is concerned, my cows are watered twice a day, immediately after they have eaten; and almost invariably every cow will drink twice a day.

I don't see as the gentleman differs much from me about salt. He said he didn't want to give too much salt; I don't propose to make my cows eat any more salt than they want. I give them salt. He mixes ashes and sulphur with his salt. I very frequently give my cows sulphur, but not ashes.

The gentleman says the best food for making milk is early-cut hay. I agree with him there, perfectly; but we have some poor fodder that we wish to work up somehow, and if we carry a good stock of cows, we can't carry them all on early-cut hay.

Dr. Sturtevant. The farms in Massachusetts contain a great variety of soil, and some of it is pretty bad. In one location, in eastern Massachusetts (I speak particularly of that), I know of a farm which would support nothing like the number of stock that are kept on it, from the good land of that farm. The only way we can carry the herd and make it profitable, is by utilizing the poor hay and poor land of that farm. At the present time, on our own farm, we are keeping a breeding herd of about thirty-two cattle, all told. We have fed one foddering of hay, and one foddering of the low-meadow hay. At the present time, we are feeding what we in Massachusetts call meadow hay (that is, muck-land hay),

mixed with a quart and a half or two quarts of grain a day to each cow, either shorts or meal. In Massachusetts we can not feed all good grass, because we haven't it. If we undertook to do it, we should have to cut down our herds about two-thirds.

Adjourned to half-past seven o'clock.

THE RELATIONS OF BOTANY TO AGRICULTURE.

BY WILLIAM S. CLARK.

Mr. Chairman and Ladies and Gentlemen:—There is much reason for gratitude and encouragement in the fact that the general subject of agricultural education need no longer be discussed at the meetings of this Board. That good mental training, some literary culture and familiarity with the laws and phenomena of nature are useful to the farmer, is no longer denied. That chemistry, by revealing the composition of air, water, soils and manures, as well as of plants and animals, has rendered a rational system of agriculture possible, is universally admitted. The chemical force, however, exerts its influence principally upon dead matter, and is subordinate to that other greater mystery which organizes mineral substances into those varied forms of vegetation which clothe the earth with beauty and furnish the indispensable food of animals.

Baron von Liebig has said: "The scientific basis of agriculture embraces a knowledge of all the conditions of vegetable life, of the origin of the elements of plants, and of the source from which they derive their nourishment." Professor Lindley also asserts that "good agriculture and horticulture are founded upon the laws of vegetable physiology;" and that "no man deserves the name of gardener who is not master of everything known as to the way in which plants feed, breathe, grow, digest, and have their being." How astonishing and humiliating then to every enlightened American must be the fact that while in Europe almost every university and every large city has its botanic garden for the instruction and entertainment of students and people, there is not in these United States a single general collection of living plants, systematically arranged and adapted to convey any adequate idea of the wonders of the vegetable kingdom. It seems, therefore, not

inappropriate to devote this hour to a consideration of the nature and objects of Botany, its relations to agriculture, and the position it should occupy in the education of farmers. The study of this science, with suitable facilities and a proper regard to its practical applications, cannot fail to add immensely to the material wealth, the intellectual and æsthetic culture, and thus to the happiness and general welfare of the community. Nevertheless many, even of our best-informed people, not only have no appreciation of its power to please or benefit, but actually regard it with prejudice, so vague and erroneous are their ideas concerning it.

Some suppose it treats merely of flowers, and consequently while well enough as a pastime for school-girls, is utterly unworthy the attention of a sensible and industrious man or woman. They have an idea that the sunflower, the poppy, the hollyhock, and such like blossoms, are the loftiest, most intricate and most profitable themes with which the botanist has to do,—which is just as correct as to suppose the science of anthropology to consist in the study of hats and bonnets. Flowers are, indeed, conspicuous and important parts of plants, where they occur, and well worthy our admiration and study. But a large portion of the species of the vegetable world are flowerless, yet they must be included in botanical science, and we shall find that the knowledge of some of them is of the utmost importance to agriculture.

Others, again, imagine the chief business of the botanist to be the gathering and pressing of specimens which, in their appearance, are calculated to awaken feelings of disgust rather than of pleasure in the breast of the unscientific observer. Dried plants are of much service for purposes of investigation and reference, but their acquisition is by no means the chief end of the science. Many a person has collected an admirable herbarium who was no botanist in any proper sense of the term.

As chemistry originated in alchemy, which was a search for the elixir of life, destined to cure all diseases, so the early botanists were incited to a critical examination of plants by a desire to procure new medicines, and ascribed remedial virtues to every species, even to the most inert. The first work on botany in the English language was entitled, in the antique style,

"The Great Herbal whiche giveth parfyct knowledge and understandyng of all manner of Herbes & their gracyous vertues whiche God hathe ordeyned for our prosperous welfare and helth, for they hele and cure all manner of dyseases & seknesses that fall or misfortune to all manner of creatoures of God created, practysed by many expert & wyse masters, as Avicenna, &c., &c., prented by me Peter Traveris, 1516." The title of one printed in London in 1551 is, "A new Herbal wherein the names of herbs in Greke, Latin, Englysh, Dutch, Frenche, and in the Potecaries and Herbaries Latin, with all the properties, degrees, and natural places of the same, gathered and made by William Turner, Physician unto the Duke of Somersettes Grace." Botanic gardens were formerly called physic gardens, and were designed especially for the instruction of physicians, the growth of drugs, and for testing the medicinal properties of new plants. The Roman emperors maintained such a garden on the island of Crete, and Montezuma had one at Mexico at the time of the Spanish conquest. Medical botany, at the present time, is merely an important branch of the applied science, and one very greatly neglected in this country. Botany, however, is something more than the science of roots and herbs.

Another common objection against this study is founded upon the fact that the botanical names of plants are in Latin, and the descriptive terms are largely derived from the ancient languages and must be learned by careful application. If the botanist had no other aim than to acquire the names of the one hundred thousand species of the vegetable kingdom it would be a forbidding and unremunerative task; though it should be remembered that a Latin word is quite as easily retained in memory as an English word that is new. Latin names are, also, much more easily spelled and pronounced than the popular names applied to plants in their native countries, when they have any, but the greater part have none whatever till Latin ones are given them. There are many obvious advantages in botanists of all nations having as they do this one universal language, and the precision of botanical descriptions resulting from an accurate terminology is, moreover, a source of very great pleasure to the student, and renders botany one of the most useful means of mental disci-

pline. Comparing botanical studies with the classics and mathematics, Professor Lindley says: "These subjects train the memory and the reasoning faculties, but they do not touch the habit of observation." This is of prime importance, and best acquired by the pursuits of the naturalist. Hence Professor Edward Forbes remarks: "The study of an animal or vegetable species is the perfection of observation as far as that species is concerned. The form, the substance, the qualities, the phenomena of existence, the influence of surrounding objects, are all observed with the greatest precision and defined so as to be capable of expression in words. No point affecting that species is left untouched. The study of a group or genus of animals or vegetables is in like manner the perfection of discrimination. All the members of the group are compared in all their parts with each other, the relations which they have in common are all summed up and their differences recorded in every possible point of view. The causes of those relations and differences are carefully inquired into and a survey is taken of the bearings of the whole group to its proximate allies, and, finally, to all equivalent assemblages in organized nature. Who can rise up from such a study and not feel mentally strengthened? The mind in such an exercise must gain in both its analytic and synthetic powers."

Another argument of great moment in favor of botanical pursuits arises from the endless number and variety of objects for investigation everywhere presented to view whereby the attention is awakened and all the powers of the mind kept in a condition of activity. In mathematical and classical studies the lack of interest often entirely hinders progress and tends to beget dullness and inattention. In the training of young men to become intelligent and progressive farmers and gardeners, the value of this kind of mental culture and discipline can hardly be overestimated. The records of worthless experiments which fill our agricultural libraries attest the truth of this assertion, and show that more education is imperatively demanded in this profession.

It has been said that a person might be an excellent botanist without knowing the name of a single species. While this is not literally true, it expresses with great force the fact that the names of plants do not constitute the science of botany.

They bear about the same relation to it that a Webster's spelling-book does to English literature. The word botany means a plant, and every plant has once existed in a single cell. All plants are either single cells or aggregations of them, and differ from each other only in the number, form and mode of combination of these their constituent elements. The foundation of our science, therefore, is seen to lie in a knowledge of the vegetable cell and the changes of which it is susceptible. By the aid of the compound microscope we learn that a uni-cellular plant consists of a globule of protoplasm enveloped in a thin membrane of cellulose. This protoplasm is in an albuminous fluid, somewhat like the white of an egg, and usually containing one or more granules floating in it, which are apparently analogous to the yolk. Under the influence of the mysterious force which we call life, this gelatinous fluid exhibits a tendency, under favoring circumstances, to divide and increase in quantity, producing the phenomenon of growth. In the simplest plants this division occurs within the outer envelope, and each portion develops upon itself a new membrane and gradually increases to the usual size of the parent. By this process, the original cell is burst and destroyed, and the same operation continues during the growing period, producing in the aggregate countless numbers of individuals. Most plants, however, consist of a combination of cells, arranged in threads, or thin expansions, or masses of various but definite forms, each species assuming at length, on maturity, its own characteristic shape and substance.

Ordinary growth, as in the grasses, occurs by the subdivision of cells into two parts by the formation of a partition in the protoplasm, and then each of these parts enlarges to the normal size and becomes a perfect cell. The lower or inner one generally remains stationary, while the upper or outer one again subdivides, and so the process goes on until the plant attains its complete development. This growth may be well nigh imperceptible, as in some of the lichens, which stand for centuries almost unchanged, or it may be amazingly rapid, as in the giant puff-ball, which has been known to form sixty-six millions of cells per minute. Upon reaching a certain degree of maturity, every species is observed to produce and cast off seeds, bulblets, or spores, usually in large numbers, for the

continuation of its kind. This may be followed by immediate death and decay, as in the mushroom and century-plant, or, as in most perennials, growth and fruiting may go on together for many years, and the decline of the vital force be gradual. In the simpler forms of vegetation we find great uniformity of structure, even when the individual attains an enormous size, as in the gigantic kelp of Cape Horn, which reaches a length of several hundred feet, but shows no distinction of vegetative organs. If, however, we plant the seed of an apple, and watch its progress from germination to maturity, we notice at once several sets of organs with distinct forms and functions. The young tree has a root which avoids the light and penetrates the soil in all directions where the conditions are suitable. It has a stem of curious construction which rises from the ground, lifting its head high into the air. It is covered with leaves, which are evidently designed to expose the largest possible surface to the sunlight and the atmosphere. After a few years of growth, a portion of its annual crop of buds develop into blossoms, which in time become fruits with seeds.

Thus the chief end of all vegetable life, so far as the plant itself is concerned, seems to be the perpetuation of the species,—the multiplication of itself. But in the wise economy of nature no living thing exists for itself alone, and vegetation is the indispensable forerunner and companion of animal existence. The air we breathe, our food, our clothing, our timber, our fuel, our artificial light, and the mechanical power of our domestic animals, and our steam-engines, are all the more or less direct results of vegetable growth. Now, living beings grow only by the digestion and assimilation of food, and one of the first objects of inquiry for the botanist is, "Upon what, and how do plants feed?" They are seen to flourish as epiphytes without any connection with water or soil; they thrive most luxuriantly in the briny ocean, and they spring out of the earth as if that were the great storehouse of their existence. The careful investigations of modern science have explained these mysteries and taught us what it concerns every botanist and every farmer to know, and what, thanks to Professor Johnson, they may now readily learn, namely, "How Crops Grow," and "How Crops Feed." We are also promised a volume, by the same learned author,

upon "Tillage and Fertilizers," that we may understand how to apply our knowledge to the production of the most profitable crops, as well as how to improve and perpetuate the fertility of our soil.

We have thus alluded to a few facts of Structural and Physiological Botany, to show what an immense and important field of research is opened to the botanist without any regard to the names of plants. Descriptive and Systematic Botany are, however, by no means to be neglected. The human mind naturally associates together similar objects, and separates those which are unlike. The classification of plants is, therefore, a necessity, and greatly facilitates the study and comprehension of the vegetable kingdom. Various systems of classification have been suggested, most of them of a very artificial character and so quite unsatisfactory. Dioscorides, for example, in the first century of our era, names the six hundred species he describes under the following four divisions, viz.: Aromatic, Alimentary, Vinous and Medicinal Plants. Linnæus made twenty-four classes, based upon the organs of fructification. This system was remarkably simple and complete, and rendered it very easy for beginners to learn the names of plants, though often associating together those which were very unlike. In more recent times, the so-called natural system has been adopted, the plan of which is to bring together groups of plants which resemble each other, not merely in one particular, but in their general characteristics. Thus we have the *Rosaceæ*, furnishing the queen of flowers and nearly all the fruits of the temperate regions; the *Palmaceæ*, containing the most beautiful and useful trees of the tropics; and the *Graminaceæ*, producing fodder for cattle and most of the bread for the human race. As there are only about one hundred and fifty orders of flowering plants it is not a difficult matter for the student of botany, with proper means, to acquire a correct apprehension of the vegetation of the entire globe, so that wherever he may be he may feel in a certain sense acquainted with the scenery about him. The importance of botanical knowledge to the traveller, or even to the reader of a book of travels, is so obvious that it hardly needs illustration. Darwin says, "As in music the person who understands every note will, if he also possesses a proper taste,

more thoroughly enjoy the whole, so he who examines every part of a fine view may also thoroughly comprehend the full and combined effect. Hence a traveller should be a botanist for in all views plants form the chief embellishment." Humboldt often expresses his admiration of the plant world. In his Cosmos he remarks that, "Although the character of different portions of the earth depends on the combination of external phenomena, as the outlines of mountains, the physiognomy of plants and animals, the azure of the sky, the forms of the clouds and the transparency of the atmosphere, it must still be admitted that the vegetable mantle with which the earth is decked constitutes the main feature of the picture."

The ability of a person to enjoy and improve the constantly changing scenes of travel will be readily seen to depend upon his previous preparation by contrasting the experience of an Agassiz with that of a common sailor upon the same journey. The one is continually under the influence of interesting thoughts and pleasurable emotions, during every waking hour of health, whether on the land or on the sea. New facts rush in upon his already crowded mind incessantly and are forthwith arranged in their appropriate places to serve his great purposes in the various departments of science. The ignorant, unthinking sailor, on the other hand, goes whistling round the world, acquiring but little information and utterly unable to use that. The mental habits and capacities of educated and uneducated men are just as different in every-day life,—on the farm, or at a meeting of the Board of Agriculture. Other things being equal, he who has the best-trained intellect and the most knowledge will everywhere learn the most and accomplish the most.

The general character of the vegetation in every country depends chiefly upon the nature of the soil and the climate,—that is, upon the amount of heat and cold, moisture and drought, sunshine and cloudiness, and the force of the winds. The least-observant traveller can hardly fail to notice the peculiarities of plant growth in different portions of the world. Even in our own country, we have regions with singular and remarkable vegetation, such as the giant cactus of Arizona, the sagebrush of Nevada, the red-woods of California, the herbaceous carpet of the prairies, and the long-leaved pines of the

Carolinas. Whoever has ascended Mount Washington must have been struck by the gradual dwarfing of the forest firs and birches, until at last they rise only a foot or two above the ground, and, before he reaches the summit, disappear altogether. The distribution of plants with relation to latitude, elevation and climate constitutes a department of our science called Geographical Botany, which is both exceedingly interesting and of much practical importance in agriculture and horticulture. Multitudes of exotic plants are now cultivated under glass in an artificial climate, and the highest success in this branch of culture can only be expected when the natural conditions of each species in its own habitat are thoroughly known and imitated. This knowledge is also invaluable to those who desire to introduce from abroad hardy trees and shrubs, as is well illustrated in the attempt to grow the Patagonian beech in England. Notwithstanding its evident ability to endure the temperature, it was observed everywhere to perish, except in a single locality on the sea-coast, where the air was very moist, as in its native land. Every intelligent cultivator of fruit understands that he must adapt the varieties he would raise to the soil and climate of his locality. Hence the American Pomological Society has prepared with great care catalogues of all kinds of fruit which are specially adapted to the different sections of our extended country. Even in Massachusetts there is a marked difference in the adaptation of varieties to localities. The bouquet of wines and the flavor and perfection of fruits is effected often by very obscure causes, and there is abundant need of well-educated and shrewd observers everywhere in the domain of horticulture. The best wines and the best fruits are always in demand at the highest prices, and only those who can produce such can hope for distinguished success. Even the age of the vine influences in a noticeable manner the quality of the wine,—so that in Burgundy, where there are productive vineyards two hundred years old, it is said the worth of a vineyard, as determined by the value of its product, cannot be known before the end of thirty years from its planting. In the Azores, young orange-trees bear fruit with a thick skin and many seeds, while trees one hundred years old and more, produce a much more valuable fruit with a very thin skin and no seeds. Around

London are twelve thousand acres of land devoted to the raising of vegetables, and six thousand acres to the production of fruit; and even in this limited area the quick-witted market gardeners have learned that each locality has its peculiar adaptations, and the principal crop of each is regulated accordingly, so that the main supply of each variety is grown in one particular section. In like manner, the finest damsons in England are said to ripen in Cheshire; and near Paris, one town in a favored site, Montreuil, sends to market remarkably fine peaches, to the exclusion almost of those from other localities. Doubtless many similar instances of special adaptations in raising fruits or vegetables occur in this country. The importance of attending to this subject will not be questioned.

The necessity for the application of botanical knowledge to agriculture is again clearly shown by the recent investigations concerning those microscopic fungi, which are among the most destructive enemies of cultivated plants, and often suddenly blast the hopes of the farmer and gardener. The Report of the Commissioner of Agriculture, for 1871, contains an interesting article on the fungi found on the fruit of the pear, tomato and grape, and the foliage and bark of the peach, the vine and the lilac, with excellent illustrations and many useful suggestions respecting their nature and treatment. The disease called the yellows, which—though unknown in Europe, where more shelter is given to fruit-trees—has almost entirely deprived Massachusetts and the whole of New England of the most delicious of our fruits, appears to be only the result of the growth of a fungus, which our peculiar climate fosters. That careful observation and experiment will devise some means for its suppression, there can be no reasonable doubt. Can we afford to neglect longer the means which are necessary to accomplish this most desirable result, as well as to aid us in preserving from similar destruction, the foliage and beauty of our phloxes, our loniceras and many other ornamental plants?

The "Monthly Report" for October, 1872, contains an illustrated article by Thomas Taylor, microscopist of the Agricultural Department, upon the onion blight and smut, which have proved exceedingly destructive in Essex County, in this State. The loss in a single season upon a four-acre field,

belonging to Benjamin P. Ware, Esq., of Swampscott, from which were obtained specimens for examination, was estimated at $2,000. Mr. Taylor regards it probable that the blight and smut are but different forms of the same species, which is very tenacious of life, and develops so fast as to ruin a promising field in three or four days. Mr. Ware states that the common custom of growing onions on the same land for several successive years cannot be safely continued after the appearance of this pest, as the spores will spring up the following year. The conservators of the agricultural interests of the Commonwealth certainly ought to encourage the study of microscopic botany at the State College, and ask for special investigations in regard to the habits and characteristics of so formidable a foe to one of our most profitable crops.

The mildew on the grape has been the cause of much annoyance in this country, while in Europe it has inflicted an annual loss of many millions of dollars in the wine districts, where it has raged for many years. In Madeira, where the vine is almost the only source of revenue, it has caused the greatest distress, reducing the people to actual starvation, so that contributions of food have been sent to keep them alive. Showering the infected foliage with dilute solutions of sulphide of calcium or sulphurous acid, and dusting it with flowers of sulphur, have proved tolerably effectual remedies; but doubtless improvements are to be sought in this direction, and M. Dumas recently proposed, in the French Academy of Sciences, that the government offer a prize of $700,000 for a means of entirely preventing the ravages of this destructive parasite.

In Europe, wheat is often attacked by a disease called pepper-brand, or bunt, which renders the grain disgusting in odor and unfit for food. It has been found by botanists to be caused by a fungus so minute that four million plants may occupy a single kernel of the grain. A similar disease, called smut and dust-brand, affects oats and barley, often doing great damage. It has been found very useful in preventing the attacks of these fungi to soak the seed-grain, just before sowing, in a solution of sulphate of soda; then to mix the moist grain with caustic lime, by which the plants or their spores are destroyed, if present.

Ergot is the distorted and diseased seed or grain of rye, and

sometimes or other grasses, caused by the attacks of a fungus, and is exceedingly poisonous to both men and animals. It is not so likely to occur on well-drained land as on that which is wet.

Rust is a disease attacking grains and grasses, and occasionally other plants, and is found to be caused by the development of minute fungi in the cellular tissue of the floral bracts, or chaff, and the leaves. It weakens the plant, and often renders the grain crop worthless. The growth of different fungi seems to depend largely upon the state of the weather,—whether dry, moist, or variable in temperature,—and is therefore difficult to control. Something in addition to what has been suggested may be done against these enemies by a judicious rotation of crops; by the selection of the most suitable varieties of seed; by improved methods of cultivation; or by removing from fields, ditches and hedgerows all those plants which support these injurious fungi, and so perpetuate them.

Another very destructive form of fungus develops in woody fibre, in close, damp places, producing "dry rot." This is so prevalent in some parts of London that wood-work in houses has to be renewed every ten or twelve years. This form of fungus may be checked in its ravages by saturating the wood with some metallic poison, as corrosive sublimate, or chloride of zinc. Fungi likewise often penetrate the wood of fruit and forest trees, beginning where wounds have been made, and gradually causing the death and decay of the entire mass of timber. In many cases, timber apparently sound, cut from dead trees, will be found on examination to be permeated by the mycelium of some fungus which on exposure to air and moisture will develop and destroy its durability. The growth of fungi on fruit which has been bruised or injured by insects, is one of the most common causes of decay. Experiment has shown that a sound apple, innoculated with fungus from a decaying one, may be destroyed in three days, and its tissue filled with the cells of the destroyer. The obvious remedy is extreme care in sorting, handling and storing the fruit.

Time would fail us to recount the damages inflicted upon the husbandman, and so upon the race, by these almost invisible, but innumerable and relentless, foes. It must answer our present purpose to state that every plant is subject to their attacks,

and that their presence even is often unsuspected, as in the case of the potato rot, the cause of which was everywhere sought in vain for many years, until at last Mr. Berkeley, the celebrated botanist of the Royal Horticultural Society in London, demonstrated that a microscopic fungus was the undoubted source of the terrible evil. "Where the carcass is, there the eagles are gathered together," and it has been discovered that the potato plant, weakened by the assault of its principal enemy, is subsequently attacked by no less than ten different fungi. More than thirty species are parasitic upon the grasses, which are infested by them, wherever cultivated, the sorghum and cane of the tropics, as well as the oats and barley of the North. The coffee-tree, the orange, the olive, and the mulberry suffer under the attacks of various blights, which, obstructing the cells and stomata of the foliage, induce disease and the failure of the looked-for crop. Even the silkworm has become the victim of a fungus, to eradicate which millions of dollars have been sent to Japan and China for the purchase of healthy eggs, which are annually imported into Southern Europe. Thus the knowledge of the origin of the disease has led to the finding of a remedy, without which one of the great industries of France and Italy must have perished. Still more impressive is the fact that epidemic and contagious diseases among men and animals are usually accompanied by the growth of microscopic fungi on or within the bodies diseased, which are often the cause of great discomfort, and sometimes of death.

The argument in favor of botanical studies might be still further strengthened by allusion to the useful qualities of some of the larger species of fungus. The chemical composition of these remarkable plants is very peculiar, and resembles that of animal fibre. Though the majority of them are exceedingly poisonous, yet more than one hundred species are used for food. The savages of Tierra del Fuego and New Zealand rely upon them as staple articles of diet, and in all parts of Europe they are regarded as delicious luxuries. In London, dried truffles are worth five dollars per pound, and other edible fungi are sold at high prices; and the demand generally exceeds the supply. In Paris, also, immense sums are expended for them, and, in 1867, there was one cultivator of common mushrooms who had twenty-one miles of beds, twenty inches in width,

devoted to this crop in the subterranean passages of the catacombs beneath the city. It is evident, therefore, that a large amount of excellent food is annually wasted in our fields and forests from the ignorance of our people, who are unable to distinguish the edible from the poisonous species, and consequently avoid them all. Many of these might be gathered and eaten, or sold in the city markets, and many more might be profitably raised by our gardeners. Even the microscopic fungi are sometimes useful. The mould, which epicures often plant in their cheeses to impart a desired flavor, the yeast-plant, which is inseparably associated with the important process of fermentation, and the vinegar plant, are examples of fungi which are beneficial in consequence of their power of producing chemical changes. Without their aid we should have only soda or unleavened bread, and neither alcohol nor acetic acid, except at great expense.

Turning now from the least among plants to the greatest, and gratifying thus our natural fondness for antithesis, let us for a moment consider the importance of botanical studies in their relations to forestry, or the care, cultivation and utilization of trees for shade, shelter, ornament or timber. Much discussion upon this subject has occurred of late with special reference to the preservation of forests on our public domain, and the planting of useful species on the treeless prairies and plains of the West. Many millions of valuable forest trees have been planted during the past few years, and enthusiasm on this subject has attained such force in Nebraska that the legislature has set apart a special day to be annually devoted to this business. While, from the nature of our government, it seems impossible to accomplish much toward the permanent preservation, or the renewal, of our forests by legislation, great good will result from the agitation of these topics by the enlightenment of the people. Very few are fully aware of the beneficial influence of growing woods upon the soil, the streams, the climate, the crops and the salubrity of the atmosphere. The planting, pruning and proper harvesting of a wood crop are not deemed matters of sufficient utility to be considered by our land-owners. Large areas of stony, bleak and barren soil exist in our own Commonwealth, which to-day would be covered with a luxuriant growth of wood, except for the per-

nicious habit of burning over recently cleared lands for the sake of one poor crop of rye or a few years of scanty pasturage. While the inventions of modern times have provided innumerable substitutes for the wood which two centuries ago seemed so indispensable for fuel, house and ship building, and a thousand uses in the arts, it is still an indisputable fact that every country, to be the comfortable abode of civilized man, must have no inconsiderable portion of its surface covered with living trees. Wherever wealth is amassed and luxuries are sought, the planting of trees for ornament and shade, as well as for fruit, will be largely practised. The millions recently expended upon the Central Park of New York and Prospect Park in Brooklyn, are indications of this tendency in the United States. But in Europe, and especially in England, where the law of entail exists, and untold revenues are hereditary from generation to generation, the royal palaces and the mansions of the nobility are environed by the most magnificent gardens, parks and forests which the art of man can create. Henry Ward Beecher is reported to have said that he never had any suitable appreciation of the power of the Almighty, as exhibited in creation, until he undertook to level a small hill. Those who have attempted grading for ornamental purposes will agree that landscape gardening is one of the most expensive luxuries, and where immediate effect is to be produced by planting large trees, the cost is enormous. This is clearly demonstrated in Paris, where one hundred thousand shade-trees are maintained by the government at an annual expenditure of three hundred thousand dollars. These trees have to be reset on an average every twelve years, and the expense of the larger ones is from twenty dollars to twenty-five dollars each.

In Europe, all the principal agricultural schools teach the whole art of forestry with great thoroughness, and the utmost care is everywhere bestowed upon the planting, keeping and cutting of timber. As a large proportion of the forests belong either to the government or to wealthy nobles, it is comparatively easy to apply there the most perfect system which science and experience have hitherto been able to devise. In Massachusetts, we can only hope, by the thorough education of our college graduates, by frequent discussions, with the

powerful aid of the agricultural press, and by the example of a few intelligent leaders, to introduce rational improvements in this department of our agriculture.

Here again botanical knowledge will prove of very great service. That no one is qualified to engage intelligently in tree culture without an acquaintance with Structural and Physiological Botany is self-evident; but familiarity with Descriptive and Geographical Botany is hardly less essential. This is admirably illustrated by the introduction of the Australian *Eucalyptus globulus*, or blue gum, into cultivation. It was first planted in France in 1856, and so rapid is its growth, that plantations of this species are estimated to produce five times as much valuable wood in the same period as an equal area of native timber. The forests of France are now valued at eight hundred million dollars. To increase the annual product fivefold is therefore a matter of some consequence. Hon. Marshall P. Wilder informs us that he saw specimens of blue gum in California which, at the age of six years from the seed, had attained the height of fifty feet. This tree has a surprising power of absorbing and exhaling moisture, and of destroying malarious exhalations from swampy and unhealthy regions. It also imparts to the air a salubrious, balsamic odor. It has been affirmed by good medical authority that the general planting of this species in the malarial districts of Southern Europe would be followed by the speedy restoration of the people to health, vigor and enterprise.

Nothing but experiments, continued for many years, can teach us what trees are best adapted for planting in New England. The ailanthus, which grows here more rapidly while young than any other hardy deciduous tree, and the European larch, which has been so successfully grown in Scotland by the Duke of Athol and others, are among the most promising of foreign species. It is, however, quite probable that Japan or China, whose vegetation seems peculiarly suited to our climate, may furnish some other more valuable kinds as yet undiscovered or untried. But we have one among our numerous native trees which ought to be planted abundantly wherever it will thrive and does not already exist in quantity. The sugar maple may be raised from seed and transplanted almost as readily as a Swedish turnip, and in a tolerable soil grows

with rapidity. Its timber is very highly prized in the arts, and the wood of its branches is most excellent fuel. No tree is more vigorous or symmetrical in form, and none suffers less from the attacks of insects. Its foliage is clean and beautiful in summer, and as the season advances it assumes the most gorgeous tints of yellow, orange and scarlet. The sap, which flows freely from incisions or borings in early spring, yields a large amount of sugar, identical in its chemical composition with that of the cane, the beet and the palm, while its peculiar flavor is far more agreeable. Trees thirty years old will furnish one pound of sugar per annum, and larger ones more, according to their size,—the greatest well-authenticated product from a single tree in one season being about thirty pounds. What more certain or sensible way of benefiting the public and improving an estate can there be than to plant a few hundred or thousand sugar maples?

When we compare the cultivated fields and gardens of Massachusetts with our native flora, we can hardly fail to be impressed with the fact that her natural productions are chiefly rocks, ice and timber. Not a plant grows wild within her limits which is capable, even if cultivated, of furnishing any considerable amount of food, so that only a few wandering savages could subsist within her borders, except for the plants which have been introduced from other regions. Our cereals, vegetables, fruits and flowers, and our principal fodder crops, are almost every one exotics, while the great mass of our staple productions remains the same from year to year; yet every intelligent person knows that new species and varieties of useful and ornamental plants are being constantly brought into notice and cultivation. With the exception of a few varieties, like the Concord grape, originated here, this work has hitherto been done for us mainly by botanists and horticulturists under the patronage of European governments and societies, many of whom maintain constantly both experimental gardeners at home and intelligent collectors searching for desirable rarities in various parts of the world. There are also a few enterprising dealers in plants who now employ travelling botanists, whose discoveries enable them to bring out novelties to attract the attention of the public to their establishments and to keep up the interest in floricultural pursuits

among their amateur customers. Extraordinary facilities for this work have been enjoyed in England, in consequence of the great number of her colonies in all quarters of the globe, and the general attention given to such matters in a country so abounding in persons of wealth and culture. David Douglas, a botanist in the service of the Royal Horticultural Society, sent to England more than fifty new hardy trees and shrubs, and one hundred and fifty new herbaceous plants, from our Pacific coast. He was finally killed by a wild bull while collecting at the Sandwich Islands, being then only thirty-six years of age. It is worthy of mention that more than half the botanical collectors who have been sent abroad during the present century have fallen in the field through sickness, accident or violence. The amount of valuable labor performed by some of the gentlemen who have gone from Europe to act as superintendents of botanic gardens in India and elsewhere is almost incredible. Dr. Wallich, at Calcutta, forwarded to two thousand one hundred applicants, in different parts of the world, one hundred and ninety thousand living plants in the short period of five years. Baron von Müller, at the present time director of the botanic garden at Melbourne, Australia, has also been indefatigable in discovering and distributing new plants, as well as in introducing foreign species which seemed likely to prove of service to the agricultural and horticultural interests of that peculiar country. Among other things, he has recommended the planting there of the cranberry, the blueberry and the huckleberry in swamps and wilds which now produce no useful fruit or root. He has also begun the culture of the tea shrub, and has lately announced the invention of a machine for curing the leaves by steam, with which two men can do the work now requiring the aid of twenty-five Chinamen. Is it not time for Americans to begin to do their share in the great work of introducing new and valuable plants into cultivation?

If, now, we have attained to any just apprehension of the nature and utility of botanical studies, we are prepared to consider what provision ought to be made for this department in the Massachusetts Agricultural College. The Board of Agriculture, as overseers of the institution and guardians of those public interests which are by law intrusted to them,

may surely be expected to regard with favor any reasonable plan for its advancement; and the people of Barre, with five of their young men now members of the College, will be eager to have the best means provided for their education in so important a branch of science, as well as in all its useful applications, especially to agriculture, forestry and horticulture. The trustees have from the first treated this department with extraordinary consideration, and done all in their power to promote its welfare. They have appropriated the most suitable portion of the College estate to its objects, and erected a tasteful building for a lecture-room, library and museum. Valuable gifts of books and plants have been made by Hon. Marshall P. Wilder, Hon. Albert Fearing, and many other liberal benefactors. William Knowlton, Esq., has given two thousand dollars for the purchase of an extensive herbarium, and the erection of glass cases for its accommodation. Dr. Nathan Durfee, himself a large cultivator of fruits and flowers, both under glass and in the open air, has built the beautiful and commodious plant-house which bears his name, at a cost of ten thousand dollars. The foundation of this department was laid, however, by Messrs. L. M. and H. F. Hills, who contributed ten thousand dollars as a fund, the income of which should be applied to the purchase of such books, drawings, apparatus and specimens as might be deemed most desirable by the director of the botanic garden.

The most pressing wants at the present time are suitable glass structures for propagating plants, for forcing vegetables and flowers, and for raising peaches, apricots, grapes and pine-apples. Till these are provided, it will be impossible to qualify students to act as intelligent and skilful gardeners. This profession, which should be most attractive from its associations and honorable from the intelligence it requires,—now filled almost exclusively by foreigners,—ought to receive large accessions from the ranks of our young men, and would, if they enjoyed the opportunity of suitable education. At least twenty-five thousand dollars are imperatively needed to complete the original design of the Durfee plant-house, and erect the additional buildings wanted. Sales to the amount of three thousand dollars per annum might then be made, which would do much toward rendering the department self-sustaining. The

proposed enlargement of the plant-house would also furnish room for the exhibition of all the most important tender exotic plantsin cultivation, and give more ample opportunity for experiments in regard to the production and improvement of varieties by the growth of seedlings, by hybridization, by modifications of heat, light, soil and plant-food in the liquid or gaseous state. Valuable results might also be obtained by the trial of various methods for the prevention of injury to plants, cultivated under glass as well as out of doors, from both the vegetable and animal enemies which cause so much loss and annoyance to the gardener.

In order to accomplish the proper work of the College in this department, whether for the instruction of its students, the improvement of agriculture in its various branches, or the advancement of botanical science, it is essential that orchards, vineyards and gardens be cultivated in the best manner, with every desirable variety of large and small fruits and esculent vegetables which are known to thrive in our own climate; besides which experiments should be undertaken with such as are new and untried in Massachusetts, but are found to be valuable in other localities. It is quite possible that varieties, originating in different regions of our own or other countries, might prove great acquisitions to us, even though decidedly modified by our soil and climate. Thus it is said the Roxbury Russet, so remarkable for its keeping qualities here, becomes in Mississippi a fine summer apple. Some French pears, like the Beurrè d'Anjou, introduced by Colonel Wilder, are found to thrive well here; while many others, apparently promising, for some unknown reason produce uncertain crops, worthless fruit or unhealthy wood. It is certainly reasonable to suppose that judicious experiments might demonstrate the fact that these modifications, desirable or otherwise, depend upon the nature of the soil in its proportion of water, clay, lime or organic matter; the aspect; the shelter or exposure to winds; the elevation above the sea level; the pruning; the thinning of the fruit; or the stock on which the variety is set. In Robinson's interesting work, "The Parks, Promenades and Gardens of Paris," are many suggestive facts relating to this matter. He informs us that even in that delightful, sunny climate, apples, pears, peaches and apricots are grown in

enormous quantities upon white walls ten to twelve feet high, with movable copings two feet wide. These walls or screens are built of brick, stone, or even of felt, parallel to each other in an east and west direction, and thirty feet apart, and only the south side is utilized. In this way the crop is certain and of the finest quality, as the prices obtained indicate. Apples of the Calville Blanc variety, raised on Paradise stocks, with shelter, are often sold at from fifty cents to seventy-five cents each, and are sent even to St. Petersburg, where they are sold for one dollar and fifty cents apiece. The finest winter pears, as Easter Beurrè, are produced in perfection only on walls; while many others, as Duchesse d'Angoulême, are grown admirably on trellises with a movable roof for protection from cold rains and frosts during spring. At Montreuil, are two hundred and fifty gardens devoted to the wall culture of the peach, the land between the walls being planted with strawberries, asparagus and other vegetables. As experimental culture must occupy a long period of years, it is of the utmost consequence to have it tried upon lands inalienably devoted to the object, lest they be sold for house-lots, which threatens the famous pear-orchard where our eminent pomologist, Colonel Wilder, has experimented with so great success in years past. The Royal Horticultural Society now cultivate in their fruit department, at Chiswick, near London, four hundred varieties of apples, three hundred and fifty of pears, three hundred of plums, four hundred and thirty of cherries, two hundred and twenty of grapes, and one hundred of figs. From this garden were distributed, in 1871, seventy thousand plants, sixty thousand packages of seeds, and four thousand five hundred packages of scions and cuttings. The possible benefit to be derived from such collections, properly managed, must be immense. The importance of having such standard plantations for the purpose of verifying names and comparing varieties, is shown in the fact that in England it has been discovered, at the exhibitions of the Horticultural Society, that the Black Hamburg grape is sold under thirty-six different names, the Black Cluster under forty-six, and the Grosse Mignonne peach under forty. If this can happen in the case of common kinds of fruit, what mistakes may not be looked for in those which are less known?

Another very useful branch of gardening which ought to receive thorough attention at the College is the raising of seeds of all kinds. The finest varieties of vegetables, grains, grasses and flowers, ornamental shrubs and forest trees, should be grown, and the seeds carefully saved for exchange or sale, so far as there might be found a demand for them. This practice would be a valuable means of education, and would benefit the public by furnishing clean seeds of reliable sorts, a most important matter to all cultivators of the soil, but especially to market gardeners, and yield an income for the benefit of the department.

Finally, liberal provision should be made as soon as possible for planting and supporting a botanic garden. This should consist of a tract of not less than thirty acres, tastefully laid out as ornamental grounds, and containing a large collection of such trees, shrubs and herbaceous plants from all quarters of the globe as will endure our climate in favorable situations with little or no protection. They should illustrate as far as possible the general characters of the various groups of the vegetable kingdom, and should be arranged with regard to the natural system of classification, and every species and variety should be correctly and conspicuously labelled for the benefit of students in botany. Besides these, there should be special collections of those plants used in agriculture, horticulture and medicine; and a Massachusetts collection, including every indigenous species of flowering plants, and all the larger and more durable cryptogams.

The proper maintenance and development of such collections as have been named necessitate extensive nursery-grounds, with suitable conveniences for propagation from seeds, bulbs, roots, green and woody cuttings, as well as by layers, grafting and budding. This, however, properly managed, would be a source of revenue, and an indispensable means for the thorough education of practical gardeners.

What then remains to be done? Why not go forward with the work and complete this magnificent design? With so many wealthy, influential and appreciating friends, nothing would be easier than to plant a few acres with interesting species, and call the collection a botanic garden. But the history of such enterprises, in this and other countries, shows

that it is not difficult to fail of permanent and satisfactory success, unless ample means are provided at the outset to defray the unavoidable expenses of such establishments.

In 1801, a botanic garden was started at Cambridge upon a small tract of unsuitable land, but it has never flourished nor been of much use, except to supply a few specimens for the illustration of botanical lectures. It certainly is not creditable to the alumni of Harvard, that, with all their munificent gifts to their *alma mater*, they have so neglected a department which has received such abundant honor in foreign universities. Quite recently it has been announced that the sum of one hundred thousand dollars has been given to establish an arboretum upon the Bussey estate at West Roxbury, in connection with the agricultural department of the University. This is a move in the right direction, and evidently made with an appreciation of the magnitude and importance of the undertaking. Within a few years, also, through the liberality of Nathaniel Thayer, Esq., excellent accommodations have been provided for the extensive herbarium principally collected by Professor Asa Gray, whose labors in this department of science have won for him a world-wide reputation. The marvellous achievements of the illustrious director of the Museum of Comparative Zoölogy at Cambridge, in procuring money for building and endowment, would seem to indicate that possibly the claims of the botanical department may not in former times have been presented to the solid men of Boston, or the state legislature, with sufficient clearness or urgency. With rare exceptions, wealthy men, burdened with the care of business, however distinguished for liberality, can hardly be expected to devote much of their valuable time to investigating the necessities of the scientific departments in our educational institutions. Hence the obvious propriety of full and specific explanations of their objects and wants, and of awakening a public interest in them, as the most rational means of obtaining the funds required for their proper support.

The only remaining item, then, to be mentioned as indispensable to the successful organization and working of the botanical department of the College, is a fund of fifty thousand dollars, the income of which may serve as the active capital of the establishment. This would be used principally

to pay for the labor of students in performing the various operations in the gardens and plant-houses, and so would do double service in the cause of education. The money thus expended would enable indigent students to earn something toward their support, would encourage habits of industry and self-reliance, and render it possible to keep the grounds and buildings in good condition without any draft upon the general treasury. Begun in the manner suggested, and carried forward wisely for a few years under an enthusiastic, intelligent and indefatigable director, the entire project would so commend itself to the public that abundant means would be furnished for needed improvements, while the annual income from sales would steadily increase with the increase of stock and reputation.

Many other subjects, which might legitimately be considered in this discussion, did time allow, must be entirely omitted, or receive but a passing notice. For instance, the great pecuniary value of even the slightest real advance in agriculture or horticulture, in consequence of the enormous aggregate value of their products, is worthy of notice. Thus an increase of only one per cent. in the wheat crop of the United States would amount to 2,877,456 bushels. There can be no question that in many ways this might be brought about. The use of the best variety of seed often does much more than this in all crops. Hence the importance of experimental grounds for testing varieties of plants and modes of culture.

Again, the introduction of new fruits or crops often results in untold good to a country. Thus the sugar-beet in France and Germany has wonderfully improved the whole system of farming, and vastly increased the wealth of these nations. In like manner the fig, the orange and the olive are valuable acquisitions to California. In 1839, a missionary transported from the splendid garden of the Duke of Devonshire to the Navigator's Islands a single banana plant, which increased rapidly, and now the people are abundantly supplied with this agreeable and most nutritious fruit. We might profitably consider the desirableness to the farmer of an acquaintance with the origin and characteristics of the weeds he would exterminate and the crops he would produce; the importance

of knowing what each cultivated plant takes from the soil and what it requires for it's best development; and the necessity of understanding the relative value of the different grasses and other kinds of fodder for his special purposes.

The exceeding value of botanical knowledge to those who attempt the cultivation of ornamental plants, either indoors or out, both in enabling them to select the best species for their peculiar circumstances, and to obtain desired results, might easily be made evident. There is now an immense waste of money, labor and love in consequence of misdirected effort in floriculture. The pleasures and profits to be derived from the intelligent cultivation of good vegetables, fruits and flowers, for the farmer's family especially, and the consequent importance of educating the students at the College as thoroughly as possible in these matters, might be enlarged upon with great propriety.

Finally, a description of some of the famous gardens of Europe, such as those at London, Paris and Berlin, would be very entertaining, and show what may be accomplished in this direction with ample means and talent of the first order, while it would also demonstrate the the comparative moderation and economy of the plan now proposed for adoption.

Thus the council having in charge the *Jardin des Plantes* have recently recommended the erection of conservatories, to cost four hundred thousand dollars, to replace those destroyed in the late seige. The magnificent palm-house at Kew is built of iron and glass, and is three hundred and sixty-two feet long, and the main portion is one hundred feet wide and sixty-six feet high, with a gallery thirty feet in hight, from which the visitor may look down upon a most superb variety of tropical vegetation. These gardens now contain the largest and best arranged collection of living plants in the world, as well as the most complete herbarium and botanical museum. Nothing could show the utility of such institutions more conclusively than the history of Kew Gardens during the past thirty years. The estimation in which they are held by the public is shown by the fact that they were visited in 1871 by five hundred and seventy-seven thousand persons. While many expensive features of these large gardens near the great capitals of Europe are neither possible nor desirable

at Amherst, yet the facilities which have been enumerated for the study of Botany in its various departments and applications are absolutely essential, if the State College for farmers is to maintain a high position as a school of science and to be eminently efficient in the advancement of agriculture and horticulture. The appropriate work to be executed there is grand enough to satisfy the ambition of the most gifted botanist, or the most wealthy and liberal patron of learning. As the field is all ready for occupation, and trees grow while men sleep, it is fervently to be hoped the planting may speedily begin.

The possible and unforeseen advantages to be derived from cultivating together representative forms of vegetation from different countries, and so imparting to beholders some conception of the variety and magnificence of the flowers and foliage with which the Creator has adorned the earth, are beautifully shown by an incident in the life of the renowned author of "Cosmos." He informs us that "the sight of a colossal dragon tree and a fan palm in an old tower of the botanic garden at Berlin, implanted in his mind the seeds of an irresistible desire to undertake distant travels." The volumes containing the results of his journeys in Europe, Asia and America, are justly regarded as among the most learned and philosophical treatises which the world has ever seen. They have been translated into all the principal languages of civilized nations, and must in the ages to come be a perennial source of instruction and pleasure to every scientific lover of Nature. Who can say that some American youth might not be inspired by the scenes in a Massachusetts garden to enter, like Alexander von Humboldt, upon a glorious career of usefulness?

In conclusion, permit me to mention a circumstance in my own personal history in further illustration of the most important principle that all faithful and worthy study of pure science, without regard to its immediate application in the arts, will inevitably result sooner or later in some substantial good. More than twenty years ago I went to Europe to qualify myself to become a practical geologist, and spending a few weeks in London, I visited the Kew Gardens. Here I beheld, with wonder and delight, the first specimen ever culti-

vated of the Victoria regia, the grandest plant in both leaf and blossom ever seen in the temperate zone. In this imposing presence the resolution was formed to create, if possible, a botanic garden in the United States, and reproduce there this superb water-lily. The consequence was that my plan of operations were changed, so that instead of seeking my fortune in the mining regions of the far West, I became in due time a teacher at Amherst. My connection with the Agricultural College resulted directly from the opportunity there offered to begin the accomplishment of my botanical purposes; and already my heart's desire to look upon the flowers of the Victoria unfolding their beauty and exhaling their fragrance in my own country has been repeatedly gratified in the Durfee plant-house. Whatever has been or may be achieved at the College through my instrumentality, must therefore be credited to the Royal Botanic Gardens at Kew.

SECOND DAY.

WEDNESDAY, December 4.

The Board met at half-past 9 o'clock, Col. ELIPHALET STONE, of Dedham, in the chair.

The first subject on the programme was a lecture on

HEREDITARY INFLUENCE IN THE IMPROVEMENT OF STOCK.

BY DR. NATHAN ALLEN, OF LOWELL.

It is but little more than one hundred years since the first systematic attempts were made to improve the stock of domestic animals. It is true, prior to that period, much interest in various localities had been expressed upon the subject, and many experiments had been tried by different individuals which, in the case of the horse, had resulted in more or less improvement. But it was reserved for one Robert Bakewell, living at Dishley, in the central part of England, to adopt and carry out, upon a somewhat extensive scale, a plan of improvement founded on certain fixed principles. The experiment was made at first more particularly upon sheep, which had in view, not only the perfection of the animal structure, but also improvement in the quality and quantity of wool. Bakewell is described as a man of remarkable origi-

nality of mind and persistence in his plans, as he encountered for some time much ridicule, and many disappointments. Success at last crowned his efforts, not only in the wonderful improvement of the stock of all those who followed his directions, but in yielding him personally large pecuniary gains. But, unfortunately, at his decease it was found that he had not left the slightest memorandum of his experience which could throw any light upon his operations, or afford any guide to others. Still there were those who, from their intercourse with Bakewell, or from their own observation, soon acquired much knowledge, and entered fully on this field of inquiry and experiment. Among these were Charles and Robert Colling of Darlington, Benjamin Tomkins of Herefordshire, Sir Thomas Gresley of Stafford, and many other persons, too numerous to mention. Great improvements were soon made in the domestic stock of England. What were called the aboriginal, or native cattle, noted for their diminutive size, their homely looks, and comparative inutility, became changed into fine stock, of large size and beautiful proportions. The ox was transformed into a noble animal, adapted to various kinds of service, and affording the best of beef. The cow became wonderfully improved, in enlargement of size, beauty of form, and capacity for dairy purposes.

As this improvement was carried on in many different localities, the stock was christened with the name of the place to which it belonged,—as the Durham, the Devon, the Ayrshire, the Alderney, the Jersey breed, &c. To such an extent was this classification carried as to amount to over twenty distinct breeds, so called, each having its own excellences, and none without some defects. In most of these cases each class has qualities peculiarly adapted to the soil, the situation of the land, and the climate of the place to which it belongs.

Specimens of these breeds have been transported to our own country, and great improvements in stock have been made here, similar to those in Great Britain. The difference in the climate, soil, locality, and other external agents, has had an influence in these changes. While there has been difference of opinion as to which was the best stock, or the best adapted to this or that place, or for this or that purpose, great interest has been manifested as to what were the best

ways, means and modes of its improvement. Breeding stock has attracted much attention, and been often discussed. A great amount of knowledge has been obtained by experience and observation; but what is wanted more than anything else is, that all the facts thus gathered, and the knowledge gleaned, should be so arranged and systematized as to show the principles which lie at the basis of all treatment, and constitute a science by itself, harmonizing with the general and admitted laws of physiology.

BREEDING IN NEW ENGLAND.

A careful review of stock-breeding in New England for the last fifty years does not present a very encouraging history, or one of uniform success. In an elaborate report upon the subject, made in 1861 by a committee composed of the most experienced men in the State, is the following. This report, in referring to the successful results attending the labors of some individuals in Great Britain, says: " It is a disregard of the rules they followed, in fact of all proper rules, which has brought confusion to the cattle-breeding of New England, and has rendered it thus far too much a profitless game of chance. Amidst the many wise and praiseworthy efforts which have been made to improve our herds, there has been a great deal of bad breeding, which, with bad feeding, has reduced the average of our stock to a very low standard. We have been led to believe that there may be somewhere an universal breed of cattle, suited to all purposes, of general excellence for the combined business of the dairy, the stall and the yoke. And with the hope of arriving at this, we have been groping in the dark until we seem to have fairly lost our way. By undertaking too much, and without proper rule, we have, as usual, accomplished but little."

Perhaps the last ten years may show a more favorable record than what this statement represents existed previously. One object in making the quotation is, to note the admission that no general rules in the matter of breeding have here been followed, and the results have not proved very successful. Another remark in the quotation we wish to notice, viz.: the " belief in an universal breed of cattle, suited to all purposes, of general excellence." If we take into consideration the

principles of physiology, and make a survey of the particular organs and qualities of the body which are needed for the dairy, for the stall and the yoke, we see that these objects, in a high state of improvement, cannot all be secured in one and the same animal. We can conceive of a perfect standard or breed in accordance with the laws of physiology. If we single out a particular animal, or set of animals, and attempt to make the most of them for a special end,—to reach, for instance, the highest possible excellence for the dairy, the stall or the yoke, we must keep that end in view, and be ready to forego those qualities that are incompatible with that end; in short, we cannot reasonably expect to unite incompatibilities, any more than an artist would think of uniting incongruous forms in modelling some particular statue.

The first step or lesson to be learnt in attempting improvement is, to know just what we want, and the next is to employ the right means for obtaining it. In order to do this, we must understand correctly the nature and character of the material upon which we are to operate, or, in other words, the laws that govern it, which in this case are the laws of physiology. The report referred to, in speaking of the selection of breed, says: "Man is governed by this law in his agricultural operations all the world over. Instinct teaches him, long before experience has led him through her many paths, that he must be obedient to Nature in that business which depends for its prosperity upon her smiles; to Nature, upon whom he leans for support, at the same time that he endeavors to direct her course for his own benefit."

What, then, are the teachings of Nature? What are the laws of physiology? What constitutes the true science or principles of breeding? What part can hereditary influences play in the improvement of stock? The object of the present paper is to solve, as far as possible, these questions. And if I succeed in presenting the subject to you as it stands in my own mind, I am confident the effort will not be in vain, neither will its influence cease with the present occasion.

But before entering directly upon the discussion of our subject, it may be well to define its meaning. Improvement of stock by hereditary influences involves very important points. It includes, not only the size and form of the body, the rela-

tive proportions of all its parts, but the selection of all good qualities, and avoidance of all bad. The aim is to perfect the organization of domestic animals as far as it can be within the limits prescribed by Nature, for all useful purposes. This has been attempted thus far chiefly by observation and experiment, without well defined and settled principles. And though much has been written and published on the subject, still persons the most experienced in the art of breeding, and who have obtained the greatest amount of knowledge upon it, feel and confess that there are agencies or principles whose nature and power are dimly discerned or vaguely surmised, operating beyond the bounds of their experience and knowledge. The author of the only distinct treatise in our country on the "Breeding of Domestic Animals," which contains nearly all the cream of previous publications, makes this admission: "It is true that some of these laws are hidden from us, and much regarding them is but imperfectly understood. *What we do not know is a deal more than what we do know.*" That an able and intelligent writer, after making a thorough investigation of a subject, should admit concerning it, that "what we do not know is a deal more than what we do know," is a singular acknowledgment. Inasmuch as I enter into this unknown and comparatively unexplored field of inquiry, with an attempt to develop some of these hidden laws, I crave your kind indulgence, and respectfully ask for an attentive hearing, and that a free and frank discussion may follow.

LAW OF PROPAGATION.

Many years since, while attending professionally families of different nationalities, the inquiry arose, What made such a difference in these families as to the number of children? And then the question took a broader sweep, extending to the changes of population and their causes in the history of different races and nations; and this led to a careful examination of all works treating especially of such topics. As a result of my inquiries, I became convinced that there was a great general law of propagation, based upon physiology, that applied, not only to human increase, but that prevailed throughout the whole animal and vegetable kingdoms. In testing this law by the changes that had taken place in

domestic animals, I found facts and arguments confirming the theory, and affording evidence of the most convincing character.

Let me explain briefly this law, with its physiological conditions. Every animal organization is complex,—is composed of many distinct organs. Each organ has a specific work to do, and in its normal state, must do so much and no more. Now, in the healthiest and most perfectly organized structure, all these separate organs are found, not only in a perfectly healthy state, each one performing its own normal functions, but well balanced, and working harmoniously together. In this case "the wear and tear," or the demands which Nature makes to support life and carry on its operations, come upon all the organs alike,—each according to its own nature.

If we divide the animal structure into several divisions or classes, the illustration will perhaps afford clearer and more definite ideas. The most natural division would be as follows, and, for the sake of convenience, we call these divisions Temperaments :—

1. The brain, the spine and all the nervous tissues—called the Nervous Temperament.
2. The lungs and the heart—the Thoracic or Sanguine.
3. The stomach, liver, bowels and organs in the abdomen —the Bilious or Lymphatic.
4. The bones, muscles, ligaments, constituting the framework of the body—the Motive Temperament.

Now, if any one class of organs indicated by one of these temperaments predominate, it disturbs the balance of organization,—and the greater this predominance, the more this harmony is impaired. When these organs are perfect in structure and healthy in action, we call their possessor a model, a standard; and upon this standard or perfect model rests the great law of propagation; here we look for its origin; here must be its seat. As you diverge from this point, the variations that arise do but confirm the law, and the results furnish illustrations more and more marked and significant of the imperative force of this law. Here comes in that well known law of inheritance, viz.: "Like begets like,"—which has been demonstrated in thousands of instances, though subject to certain conditions.

As all animals deviate more or less from this perfect standard, we have every variety of organization. No two structures are exactly alike. If the principle "Like begets like" applied to only one animal structure, its operations would be simple and easily traced out.

LAW OF INHERITANCE.

We have, then, two agents in which there is a great difference, not only in the development of individual organs, but in whole classes, or in one of the temperaments, so called. It is this union or combination of similar and dissimilar qualities that the results or effects of inheritance must be estimated. As a general thing, the greater the difference the more marked the results; and, on the other hand, where there is great similarity in the agents there will be sameness in results. The great general law is based upon the perfection of the whole organism, and the harmony of function in the operations of every individual organ; but in its application the law applies to every kind and variety of structure.

In some respects this law may be compared to the principles of gravitation, electricity, or chemical affinity where their application is affected by or dependent upon the material upon which they operate. In order to understand the nature of the law or general principle, we must take into account all the conditions that modify its operation. It is sometimes very hard to do this. Nature does not always reveal her secrets. In the early history of all the sciences, it has been found difficult, and has required a long time to remove, all obstruction and doubt in the settlement of general principles; but all this toil and delay does not disprove in the least the existence of such principles.

It may be remarked that this whole subject of inheritance or hereditary law is very imperfectly understood. It is true a few individuals have given it some special attention. Some have recorded the results of their experience and observation; but there are more who have acquired a great amount of practical information upon the subject, but made no record of the same, so that those who came after them are but little, if any, the wiser for it. Even in human physiology, where these principles would naturally be considered of the greatest im-

portance, we have no well defined or established directions to aid us, or throw much light upon this topic. It is true that the general fact of resemblance of children to parents has long been admitted; but then we have no guide or rules whereby every feature and shade of this likeness can be traced out between the offspring and the parent, or dissimilarity accounted for. While in books and journals there are many admissions that there is, and must be, much truth in this law of resemblance, you may search medical and other libraries through and through without finding a single treatise or scarcely an essay that discusses this topic in an intelligible manner. But it is an encouraging fact that the most progressive men in the medical profession, both in Great Britain and in our own country, are waking up to the truth and importance of this subject, especially as it is manifested in the transmission of disease. A careful inquiry into the diseases of a person's parents and ancestors enables one to understand more distinctly what are his predispositions to particular diseases, and what are constitutional and what are not.

PHYSIOLOGY IN ITS INFANCY.

Some allowance should be made for the want of more definite knowledge on this subject of inheritance when we consider that physiology is really a modern science, and in some of its practical applications it is in its infancy. It is only a few years since the relation between pure air and the healthy state of the lungs and the blood became known, or the importance of regular exercise of all parts of the body, in order to maintain good health. The relations which the physical system, with its various organs, sustains to education and religious culture, are as yet very imperfectly understood. So is the application of sanitary laws to public welfare; also to the prevention of disease and the preservation of human life. The community has not as yet begun to realize the great advantages to be derived from a knowledge of this science in the promotion of human comfort, health and happiness. When its principles are brought into application in every-day life practically in all their bearings, it will be difficult to find language strong enough to express all its beneficial results. Especially will its advantages be conspicuous in the early care

and training of the child,—in multiplying and regulating the comforts of home, in improving the modes of education, in adapting the fashions of the day to the laws of life and health, in correcting many evils connected with our public institutions,—in demonstrating the great fact that all codes of morals and developments of religious character, in order to be what the Creator intended, must harmonize with the laws of the physical system. Upon each and all of these topics the principles of physiology are destined to have a powerful and most beneficial influence. When the public mind becomes properly enlightened upon these points, the great law of inheritance will stand out as one of the most prominent agents in the advancement of the race. It cannot be that the most important law in the universe for the permanent improvement and elevation of man should always be so imperfectly understood or so generally ignored. Such ignorance and violation of law cannot always continue. Judging from the history of other sciences, and from the rapid changes taking place in almost every department of society, we predict that in the next fifty or one hundred years there will be found in the direction here mentioned the most surprising improvement. I am fully aware that there are difficulties in the way of making a complete or perfect application of this law to the human species; but then these difficulties are not insuperable. Just in proportion as the rays of light and truth break in upon this field of inquiry, the clouds of ignorance and prejudice will disappear. If there are such important laws, a knowledge and observance of which are indispensable to the highest welfare of the race, a way will be provided whereby they can be correctly understood and obeyed.

While many of the laws of inheritance are the same in the human race as in the other animal races, there are three great points of difference between them. And these points of difference are. radical, fundamental and fixed; and in making an application of the law, their existence and influence must be taken into account.

DIFFERENCE IN INHERITANCE; HUMAN AND ANIMAL PHYSIOLOGY.

The first distinction is reason and instinct, or the intellectual and moral nature of man,—that all the faculties which distin-

guish him from the animal have a most powerful influence upon this law of inheritance.

The second difference is the marriage institution, and, without resorting to revelation at all for a divine sanction of this institution, we believe its necessity can be proved upon physiological laws alone,—that the health, happiness and highest welfare of the race requires just such an institution; in fact, that the human species as a whole cannot be perpetuated in its highest type without the marriage relation, and that the law of inheritance must act in harmony with its sanctions.

The third distinction is in the objects of creation. Man is a free moral agent, accountable directly to his creator for all his powers and his acts; but the animal was created with a very different nature, and for different purposes. The laws that govern his organization can be more easily applied and directed, especially by human agency. They are not only more simple and less complicated, but can be brought to bear more directly and with more immediate results. This law of heritage is here in a great measure, not only under the control of human agency, but what may be called the physiological influence is small compared with what it is in the human species; and then the external agents, such as food, climate and exercise, can here be directed and applied far more aptly and successfully.

Without pursuing the subject farther in its relations to the human species, we proceed at once to examine what evidence and illustrations of the reality of the law can be deduced from the animal kingdom; or, in other words, explain what constitutes hereditary influence in the improvement of stock, premising that the same class of facts and arguments that show improvement here, affords evidence that similar laws appertain also to human physiology.

In changing or modifying the results of hereditary influence, there are three great agents which claim a passing notice,—they are climate, food and exercise. These agents, though slow in their operation, have a powerful influence in changing physical organization. They may act separately or all combined. By climate we understand the changes in the weather, and the temperature and purity of the atmosphere. Some animals in their very nature are adapted to one climate, and others to a

different kind. One breed will flourish in one locality, but not in another. But in regard to the state of the atmosphere, all animals are more or less affected, and whenever confined indoors an abundance of pure air is indispensable.

In modifying and changing the growth, development and character of the animal, food has more influence than climate,—its kind, quality and quantity, and modes of taking it, are all important. Not only the whole body, but particular organs, are very much influenced by the kind of nutriment. So, also, in regard to exercise or habit, this will do wonders. These last two agencies, food and exercise, in order to effect great changes, require much skill and attention, as well as time.

GOOD MATERIAL NECESSARY.

But however great the changes that may be wrought by these external agents, the right kind of material is indispensable to start with. Probably in no mechanical or manufacturing pursuit, where the greatest skill and ingenuity are requisite, is choice material to work upon so necessary as in the production of good stock. These external agents may change and modify animal organization to some extent, but they cannot create or make new; and the better the raw material, the less these external agents have to do, and, at the same time, the more visible will be the results of their agency.

Accordingly, in all works upon breeding, the two leading directions are, first, decide just what is wanted; and second, seek the best stock that can be found to breed from, or that which bids most likely to produce the qualities desired. But, then, how are we to do it? Where are the directions? Where are the principles of science to guide us? The books place first upon the list "pure blood;" but strictly speaking, blood, in its normal state, is the same in all domestic animals. It possesses fibrin, albumen, and a few other chemical properties in certain proportions, being precisely the same properties, and united in the same proportions, as found in all healthy stock. It is true we have here the word "pure" attached to it; but if we were required to define exactly, in a few words, its meaning,—what "pure" is, or in what consisted the purity of the blood,—we should find it a difficult task. Still the phrase "pure blood," as here used, is full of meaning. It is

one of those technical or conventional phrases which is very expressive, and is much better understood, probably, than some long or elaborate description. There are two other terms frequently used in the directions upon breeding, viz.: "pedigree" and "thorough-bred." These terms, as here used, are very appropriate and significant. While the term "pedigree" means simply lineage, genealogy,—a list of the names of ancestors, with some description of their characters,—the word "thorough-bred" is more expressive, and denotes that this lineage, on both sides, is composed of the best stock, which has come down, as far as can be traced. As in the propagation of plants the finest seeds in each successive crop are culled with care, to be planted in their turn at seasons and in soils favorable to their growth, so among animal tribes an analogous care and treatment have chosen and scrupulously nurtured the finest products of each successive generation.

There is another point which is very important in the improvement of stock. It may be implied or included in the directions already laid down; but if so, it deserves special notice by itself. It is this, avoid every defect in structure, function or looks, as far as it can be detected, or even suspected. This may consist in some weakness, or some excessive development in certain parts or organs, or in marked tendencies to disease, or in external appearances detracting from good looks, or indicating a depraved disposition. All writers agree in saying breed only from the best stock. Says Mr. Goodale, "The most perfect animals of both sexes should always be selected and employed in propagation." Says Mr. Sturt, "Good breeding cows should always be healthy, robust and well developed in every part." Says Dr. Loring, "Harmony of structure and a proper balancing of desirable qualities are indispensable." Says Prof. Law, "The animal, whether male or female, that shows the most vigorous health—being neither too obese and plethoric, nor too thin and weak—is likely to be the best stock-getter." One object in noticing these directions and quotations is, to show wherein they harmonize with the great law of propagation which we advocate; and in order to a better understanding of that law, we will define it again. It consists in the perfectionism of structure and harmony of function; or, in other words, that

every organ in the body should be perfect in its structure, and should each perform its legitimate functions in perfect harmony with all others.

LAW OF PROPAGATION DEFINED AND ILLUSTRATED.

This is the standard, the model upon which this great law of propagation is founded, though subject in development to many conditions, inasmuch as the deviations from this standard have been so great, and are so diversified.

No animal, however, has this perfect organization. We find only approximations towards it in endless variety; and then, as we apply the laws of similiarity or resemblance,—that "like begets like,"—we have two distinct agents, possessing various and unlike qualities, from which, the product is to be obtained. In this complex and twofold organization, we have a certain kind and amount of capital, which, in order to bring about successful results, requires nice discrimination and careful management. In the mixing up and blending of similar and dissimilar qualities appertaining to every organ of the body, we may get sometimes the resemblance, more or less, of one progenitor, and at other times the likeness of the other. The strong and sharp points of the one may by this union be modified or softened down by the better and milder qualities of the other. Then again this union may result in a combination of qualities, which will become more marked and predominant than are found in either parent stock. Thus there may be great improvement which cannot be secured in any other way, and on the other hand defects or evil tendencies may be transmitted in an intensified form.

Here comes in the law of inheritance, by means of which many of the difficult problems in breeding can be explained. The more perfect the animal is in all its organs, the sounder is its constitution, the better its health, and the more beautiful its form. But to obtain such an organization time is required. There must be the most careful selection of the parent stock; nice adaptation and watchful management, extending through several generations. It is in this way that you obtain "pure blood," by continuously weeding out all defects or impurities in organization for a long period of time.

In applying this law of inheritance there are several considerations to be taken into account. First: If there is a great similarity of organization in the parent stock,—an even balance of organs on both sides,—there will be a resemblance in the progeny, though generally an improvement, and seldom any marked excesses or defects. When this course of breeding is followed, it takes a long time to bring about marked changes, either for better or worse. But as there are many secondary causes, both internal and external, operating to change the development of certain organs of the body, it becomes very difficult to perpetuate this standard through successive generations. Then we should add to these causes the agency of disease, which may seize the most perfectly organized animal, when its symptoms, which lurk unnoticed in the system, are not visible at the time, and when its effects are slight at first, but by transmission from generation to generation grow into most serious evils.

BREEDING "IN AND IN."

There is one mode of improving stock which can be explained by this law of propagation in a most satisfactory manner; in fact, can be explained in no other way. We refer to the practice of what is called breeding "in and in," which has had both its advocates and opponents. This practice has by some been attended with great success, and by others with equally as marked failures. There certainly must be some things or conditions in it favorable, while, on the other hand, there are some unfavorable. Now, what are these, and what is the explanation? It surely cannot be in the blood or mere relationship alone, for the chemical qualities of the blood may be precisely the same in all, and whether it courses in larger or smaller quantities within the kindred circle, this difference cannot produce such marked results. The same principle applies to the human species in what is called the "intermarriage of relations." The evil consequences here are not more marked. It has been found, by a long series of facts, that the nearer the relationship the worse have been the results, and that in the second, third and fourth degrees of kindred the evil results have grown less and less. The great secret is, that in this close relationship there is found an organization too much

alike, or badly matched, with certain defects, weaknesses, or excesses, which are transmitted in an intensified form. And as you depart from the parent stem, or fountain-head, you find an organization more perfectly and evenly balanced, better matched or adapted, so that the stock, though kindred, is improved in its transmitted qualities. Thus Bakewell and some others in pursuing this practice of "breeding in and in," by carefully selecting the best stock to breed from, and continuously avoiding the defective, made in the course of a few generations great improvement. The trouble here is, that the manager, after being very successful, becomes careless in his selections, makes a slight mistake now and then; or he is deceived by some hidden defect or occult disease, which at first could not well be discovered, but by increasing from generation to generation becomes an evil of great magnitude. In one case, the question has two sides, viz.: the practice of "breeding in and in" has been attended with great and long continued success; but, on the other hand, it has proved a failure both in a multitude of single instances, as well as on a large scale. If the causes of failure in all single cases, or in each generation, could be discovered, we should in every instance be able to account for them on the law of propagation.

Mr. Goodale, a well-known writer upon breeding, after carefully considering the subject, comes to this conclusion. The continuance of health, strength and perfect physical development is believed to depend on the wisdom of the selection, upon the presence of the hereditary qualities, and the absence of injurious ones, and not upon relationship, whether near or remote. "But, then, inasmuch as these injurious qualities are more liable to exist in close relationship, such breeding should be avoided." Now, why this liability and the necessity of departing from this line in breeding, if there is not a great general law in nature to govern all these changes?

CROSS-BREEDING.

Intimately connected with this part of the subject is another, viz.: what is denominated "cross-breeding." At first this might seem to be a practice or scheme directly opposed to the one just considered, but it is not strictly so. The word

12

"cross" has a conventional meaning. The original use of the term seems to have applied only to alliances of animals from distinctly different breeds, and even from what might be different species. Here the "crossing" would imply the uniting or blending of very opposite and sometimes antagonistic qualities,—almost the formation of a new kind of stock or breed. But we believe the term cross has a more common and general signification; that it is the bringing together of simply opposite qualities for the purposes of improvement, or more particularly to secure some one object; to change the development of the animal in a certain direction. In the case of the horse it may be to secure more speed or strength; in the case of the ox, more meat; of the cow, a greater quantity of milk, and of the sheep, more wool. With this definition of the word "cross," it is capable of being applied in an almost endless variety of ways, and constitutes a most fruitful source for the improvement of domestic animals. Here it is necessary to decide, in the first place, upon just what is wanted, and then by careful discrimination, to select and match in the parent stock, such qualities as united will be most likely to bring about such and such results. Then again, time is necessary. If too great or rapid changes are expected at once, they will certainly fail. Time and patience are as requisite as close discrimination and perseverance. As far more attention has been paid to the improvement of the horse than any other animal, we here quote from a distinguished writer upon physiology the following remarks. Says he: "Harmony of structure and a perfect balancing of desirable characteristics, an equilibrium of good qualities, can be secured only by great pains. It is not enough that the animal machine is put in motion by the noblest spirit, or that it is nourished by the highest blood; every bone must have its just proportion, every muscle or tendon its proper pulley, every lever its proper length and fulcrum, every joint its most accurate adjustment and proper lubrication; all must have their relative proportions and strength before the motions of the machine can be accurate, vigorous and durable. In every machine, modifications are required according as the purposes vary to which it is applied. The heavy dray-horse is far from having the arrangement necessary for the purposes of the turf, while the

thorough-bred is as ill adapted for the dray. Animals are therefore to be selected for the individual purposes for which they are intended, with the modifications or organization requisite for the different uses to which they are to be applied; but for whatever purposes they may be intended, there are some organs which are common to all, in the adjustment of the individual parts. If the bones, in the case of the horse, want their due proportions or are imperfectly placed; if the muscles or tendons want their proper levers; if the flexions of the joints be interrupted by the defectiveness of their mechanism; the animal must be defective in motion or strength; the bones have irregular pressure, and if they do not break become diseased; if the muscles or tendons do not become sprained or ruptured, they are defective in their action; if friction or inflammation does not take in the joints, the motions are awkward and grotesque. As in every other machine, the beauty and strength of the animal, whether in motion or at rest, depends upon the arrangement of the individual parts."

In making this long quotation we have a twofold object in view; one is to show that in the necessity of this harmony or balancing of organization, illustrated in the history of the horse, there is strong presumptive evidence that there must exist a great general law of propagation in the perfect structure of all the organs of the body, and then would follow this harmony or balance in the performance of their functions. The same evidence that proves the necessity of a part or fragment of the law of inheritance, demonstrates the existence or truth of the whole law.

Another object or design of the quotation is to show that if there must be this perfect development in the framework of the horse, with all its nicely adjusted parts, in order to give beauty, speed and strength, how important that those vital organs,—the heart, the lungs and the digestive organs,—be well developed and kept in sound running order! and then that this same illustration be applied to other domestic animals. But the idea of having a perfect organization in all its parts conflicts at once with the specific uses which we have for domestic animals. Utility here is the controlling consideration, to which all other things must be made subservient. The ox is wanted for labor or beef, the cow for meat or milk,

the sheep for mutton or wool, the hog for pork, but the horse for such a variety of service that nature's standard here can be preserved or imitated far better than in either of the other departments. Accordingly we find upon the examination of horses the rule practically holds good. If labor is the sole or principal object to be obtained in the ox, the size, the framework, bones and muscles, the limbs, certain portions of the body, external and internal, must be made prominent, must be particularly developed; but if beef is the principal object sought, a different organization in some respects becomes necessary. So of the cow; if the dairy is the main object a very different class of organs must be developed. So of sheep; when the best and largest quantity of wool is desired a peculiar organization must be looked after and cultivated. It requires much time, care and patience to bring about these changes; for, if properly made, it must be slowly. Now, in order to obtain the objects named in any one of the above classes of animals, it becomes necessary to make very predominant a certain class of organs; in so doing there is danger that a different class of organs shall not be sufficiently developed to carry on properly the functions of health and life. This is not theory, but matter of fact. Nature has fixed bounds, beyond which we cannot go in developing certain parts, or perfecting the organization of any animal for specific purposes. Accordingly, it has been found, both in Great Britain and our own country, that where certain stocks or breeds have thus been kept up to a high standard for some time, and attempts have been made to advance them still higher, they have degenerated in spite of all the pains that could be taken. It is highly important to keep this principle constantly in view, and to understand, as far as possible, these bounds or limitations of improvement. This fact also affords evidence in proof that there is somewhere in nature a great law of propagation, of which these minor principles are only "part and parcel;" simply stems from the parent stock.

QUALITY OF STRUCTURE.

There is one feature or consideration in the matter of breeding that should be kept constantly in view and made prominent; and that is, quality of structure, firmness of fibre and

texture. This is implied, perhaps, in the *kind of breed* or, in the use of the phrase, "pure blood." But, strictly speaking, it is not always included, or at least sufficient importance is not attached to it. In the various works and reports upon breeding this feature in stock is occasionally referred to or described; but its full value and extent of influence, it appears to me, are far from being appreciated as they ought. We know what importance is attached to quality,—the fineness of texture in most fabrics of manufacture,—for instance, cloth,—that if the strength is not sacrificed, the finer the quality, generally speaking, the more valuable the material and serviceable its use. The same principle applies, in some respects, to animal organization,—not to one part in particular, but to the whole structure. In fact, it cannot prevail in the hair or wool, in the muscles or glands, without pervading every part and parcel of the system. There is uniformity or sameness in this respect throughout every tissue. But its importance, however, must vary according to the particular uses to which the animal is applied. The horse or ox, intended for hard service, may have a coarser texture than when the former is required for great speed or the latter for fine beef. In the cow, the quality and quantity of milk depends much on the fineness of the fibre or texture throughout every tissue of the body; so in the sheep, the quality and quantity of wool are affected very much by the same cause. We know that the value of meat in all these animals depends also much upon this same cause.

This feature in organization sustains a very intimate relation to the law of inheritance. Fineness of texture is of very slow growth, and it requires several generations in order to effect any great alteration and improvement in this respect. Climate, food and exercise can do considerable to shape and modify the development and character of animal life; but the primary elements of quality, the fineness of texture, must exist in the structure itself; they must be inherited. In selecting, then, the parent stock, this feature must be carefully looked after; and not only on one side, but on both; and then the matching or adaptation of two parties in this respect, so as to produce the most desirable results. The question may be asked, Can this feature in animal organization

be discovered; are there external marks or signs to guide us in the selection? Certainly; signs that can be easily detected in the form of the body, in the shape of the limbs, in the hair and skin, and in the movements of the animal. A little experience and discrimination will readily put one on the right track.

Closely identified with this part of the subject, there is a feature of great importance, especially where labor is required, viz.: hardness, toughness, power of endurance, &c. While this element is greatly enhanced by habits of exercise and exposure, it depends more upon quality of structure combined with a well-balanced organization. These conditions must be supplied in a great measure by inheritance, and it will be seen by careful analysis and comparison, that the nearer we approximate in organization the true law of propagation, the more of these qualities shall we obtain.

Connected with this quality of structure, there is one point worthy of consideration; that is, that there are bounds or limits to it,—not merely upon the ground of utility, but of existence. If both parents possess this kind of organization in a high degree, it is transmitted in an intensified form, and the farther it is carried, experience shows the stock will gradually run out. Thus, as we approach the two extremes, fineness and coarseness of organization, we shall find that animal life will decrease more and more. Thus from these two stand-points we derive strong presumptive evidence to show that there must be a great general law of propagation somewhere between these two extremes.

DISEASE INHERITED.

One of the most important points connected with hereditary influence is the matter of disease. No law in nature is more firmly established than that disease, or rather the morbid conditions that generate it, are transmitted. This may exist in the very structure itself, or in the fundamental derangement of some particular organs. And it is a well-known fact that certain kinds of disease are more liable to be transmitted than others. The fact also is well established that animals, in proportion as they become domesticated, become thus more liable to disease; and, at the same time, their complaints assume

greater complication. Hence, the liabilities of transmitting disease are increased.

When diseases are called transmissible, or hereditary, it is not meant that disease itself is transmitted in an active stage, but a morbid state or predisposition that necessarily results in disease. This, of course, is generally of a chronic character, and is far more difficult to detect than acute disease. At the same time some chronic complaints, like rheumatism, consumption, and those of the stomach and bowels, are somewhat easily discovered, while others are difficult of detection, being latent and internal,—such as the scrofulous, the tuberculated, and those that particularly affect the liver, the kidneys and the blood. In the improvement of stock it is of the highest importance that we should guard against the first approaches of all hereditary diseases. No one thing can possibly injure the value or use of stock as some form of scrofula, which may be concealed in the system for years, or may be transmitted through successive generations, afterwards to break out. As it is very difficult to distinguish by any external signs or symptoms this class of complaints, our protection from them must depend mainly upon pedigree or the character of the breed. As in all sanitary matters, prevention of disease is the great secret of success, so here the means that are most conducive to its prevention are of the highest importance. Now, the nearer we approach in breeding the true law of propagation, by keeping up a harmony of balance in the whole organization, by avoiding the transmission of weak parts or organs inadequate to perform their legitimate functions, the less will be the liability or predisposition to disease. In fact, as disease, wherever found, is a violation of some law, it would seem that those principles of breeding, whose chief aim is to prevent disease of every kind, must have their source and fountain-head in a great law of propagation founded in nature, which is universal and eternal.

Closely connected with this part of the subject is another which exerts great influence, viz.: the physical condition of the parent stock just before and at the time of begetting offspring. The male and female both should be in a most vigorous and healthy state, neither given to indolent repose, nor subjected to hardships or excesses of any kind. It is almost

unnecessary to state here that the condition of the female during pregnancy has a powerful influence upon offspring. The great stress is laid upon this point in books and reports on breeding; still its effects are far, very far from being overrated. The pregnant female should have a plenty of the best nutrition, abundance of pure air, proper exercise, without excess or deficiency. There is found a surprising difference in the adaptation of female organization for begetting and nursing its young. If the number of those among domestic animals deemed by an expert just fitted for such purposes were sorted out, the proportion, we apprehend, would be exceedingly small. While special care should be taken to select a female having a predominance of those qualities desired in the young, equal pains should be taken to see that she have a good development of those organs requisite for nursing her offspring. The health and constitution of the animal depend greatly upon having a good start at the commencement of life, and this is effected by having the right kind and sufficient quantity of nutriment more than anything else. If perfect female models could be selected for breeding, they would correspond, we believe, precisely with that standard whereupon nature has planted the true law of propagation.

There are two or three considerations connected with the female, that have a powerful hereditary influence. First, the female should not be too young or too old; in either case the offspring suffers in point of vitality and strength. Second, there should not be too great dissimilarity in the size and relative proportions of the body, between the female and male. If so, the offspring may suffer with an irregular or unsound organization, and if the male is much the largest, the life of the female may be endangered in the delivery. Third, the female should have relatively a large abdomen and chest. Large lungs and strong digestive organs are indispensable to afford proper nutrition to the fœtus. An even temperament is also necessary where the disposition is quiet and docile, and the instincts decidedly maternal.

A topic intimately connected with this part of the subject is the question often raised, Which has most influence upon the offspring, the male or the female? and can distinct lines be drawn in the organization, showing the hereditary influence

of the one or the other? The attempt to settle this question has led to various speculations and discussions. It has been maintained by some, that the male had most influence; by others that the female had; by others still, that the framework and external parts of the body were communicated by the male, while the internal organs were transmitted by the female. Some have attempted to prove that this transmission took place by halves, and they have divided the body into two distinct parts, mapping down this organ here, and that one there. But amid all this diversity of opinions, and after protracted discussions, no one theory has prevailed, and no one general principle has been established. While it is admitted on all sides, that, as a general rule, the parent stock is more or less represented in the offspring, sometimes in a blending and interfusion of the qualities of both, and again in a most striking resemblance to the one or the other, that such is the aggregate of these qualities of resemblance, as to cause a certain type of family likenesses and organic qualities to be stamped upon great numbers through successive generations, and that all these changes must take place under the direction of some fixed laws; is it not presumable, with these facts before us, that there may be founded somewhere in nature a great primary law of propagation, of which all these various changes are but the result of fragmentary parts?

Suppose the principles of breeding advocated in this paper had been admitted for the last fifty years as correct, and had been generally understood, would not the great mass of facts gathered, and the experiments tried, have been turned to much better account than they have been? Would not the observations made in this most important field of inquiry, and the discussions therein, have resulted in settled principles of science? We must have something more than isolated facts, anomalous cases, and the experiments of individuals without any guiding principle. In fact, speculations and discussions have been carried on about as far as they can be towards settling these questions, or for advancing anything like science. For the sake of making improvement there is need at the present time, above all things, of introducing and establishing some great general law or principle around which all facts, all observations and all discussions will centre and crystallize.

But we have this fact for our encouragement. In the early history of all the sciences there have been the periods of much confusion, diversity of opinion and gleams of light, before the bright rays of the sun appeared. We are surely making progress in the right direction. All great principles work slow, but they are sure to triumph in the end.

DARWIN'S VIEWS.

Within a few years there has been a greatly increased interest in all scientific inquiries, but more especially in what are denominated the Natural Sciences. The questions that have created the greatest interest come under the heads of Physiology, Psychology and Biology. Among the subjects that have attracted most attention, hereditary influences stand prominent. And no one has made here greater or more valuable contributions than Charles Darwin. Without approving or indorsing all his theories upon the "Origin of Species" and "Descent of Man," I propose to make some comments upon his views bearing directly upon the topic now under discussion. The two great principles that underlie most of his inquiries, namely, "Natural Selection" and "Law of Variability," have, in our opinion, a sure foundation in nature, and will survive all opposition and criticism.

A radical mistake or defect in the application of Darwin's theories, it seems to us, is this: he bases them upon nature in a chaotic, imperfect state. Whereas the great laws or principles of science must be based upon nature in her highest developments. Nature in her primeval state is perfect, and all her laws must start with or be tested by a perfect standard. While the operation of these laws extends to the lowest stages of physical organization, their origin or basis is found in its highest and most perfect state.

Darwin's leading principle, namely, "Natural Selection," may be briefly defined thus: It is the preservation of favorable qualities and the rejecting of injurious ones. It has been found from long experience by actual experiment that man can improve the character of domestic animals by selecting the most desirable qualities, and by avoiding all that conflict with these. Darwin maintains that this same principle exists in nature; that amidst all its laws and changes there is an in-

herent tendency for betterment—for improvement; and he calls this principle, natural selection. It is most strikingly manifested in all organic beings in their constant "struggle for existence," and is happily expressed in the phrase often used by writers, "the survival of the fittest."

Now we maintain that this same principle not only harmonizes with, but is nothing more nor less than the great law of propagation, based upon the perfectionism of all organization; and what are denominated "Laws of Variation" by Darwin, and which he has discussed extensively, may be fully explained by the laws of hereditary descent. When we take into consideration the fact that the true law of propagation is based upon a perfect standard in nature, all changes or deviations from that standard or model come under the law of inheritance. With this explanation it will be seen at once that a wide and varied field is laid open for its operations. It is subjected to a great variety of conditions, not only within the body itself, but to numerous external agents, such as climate, food, exercise, etc. At first thought there are so many anomalous cases, so many apparently contradictory facts and secondary agents, it would seem almost impossible to arrange them all under any one general principle. But the more carefully the whole subject is examined from different points of view, the more clearly, we think, it will appear, that this classification of facts, this explanation of phenomena can be reduced to a general system. This position of things may be illustrated by the history of other sciences, in which there were periods when great masses of facts had been accumulated, and many and long discussions had been held without much satisfaction; but just as soon as some leading principle had been discovered, all these facts and theories come into line, and receive a satisfactory explanation. If the immense collection of facts gathered by Darwin in his book on "Variation of Animals and Plants" is carefully analyzed and classified, according to the two great laws of propagation and heritage, they become not only far more intelligible, but afford strong evidence of the truth of these principles. In fact, we have found in Darwin's contributions to science, a great storehouse of facts; a grand accumulation of evidence in proof of some views upon the law of population which we had entertained

many years before his works were published in this country. Did time permit, we might cite from his writings numerous references or quotations, which would furnish most striking evidence in proof and illustration of this law of propagation, as applied, not only to the human species, but also to the domestic animals.

VEGETABLE PHYSIOLOGY.

In that part of Darwin's works treating of plants, we find strong evidence that this same law prevails throughout the vegetable kingdom. The same may be said also of other writers on vegetable physiology. It is a fact well attested by gardeners, that in order to produce flowers and fruit the soil must not be too rich or too poor. If the plant or tree grows too luxuriously, its branches or roots must be pruned; while on the other hand, if unthrifty, it must receive better culture and its roots be enriched before it will become fruitful. So the most beautiful flowers and richest fruits have few seeds, which in time run out, while those of a poor quality may abound in seed, but will not flourish long. It is true, the conditions here vary, and so do the modes of perpetuating life; but by analogy in a great variety of ways, we believe that strong arguments may be deduced from the laws that regulate the continuance, increase and decay of vegetable life, to confirm the truth of the principles of propagation and inheritance as advocated in this paper.

But some of the strongest evidence in proof of this law is found in human physiology. It presents to man the highest standard of health, of longevity, of happiness, of strength, of beauty, etc. Proofs are derived in its favor from the laws and changes of disease; from the causes of fertility and sterility; from facts connected with insanity, idiocy and mutism; from the transmission of genius and other mental peculiarities; from changes in population, explaining why certain tribes and races increase in numbers for generations, whilst others decline; why the highest and the lowest types of human organization, after a time, also decline; and that those having an organization between the two extremes, are found best fitted "to be fruitful, to multiply and replenish the earth."

It may appear to some that the law of propagation as here

presented is mere theory, and has no foundation in nature; or if such a law does exist, it is impracticable, and cannot be applied to any useful purposes. We think both these impressions are altogether a mistake. A careful and thorough investigation will disclose, we think, such an amount of evidence in support of the theory as to open almost any mind, not only to a measure of conviction upon the subject, but to its vast importance. Some may inquire if there is truth in these principles, why were they not discovered before? The same question might have been raised in reference to other great discoveries. It seems to have been the design of Providence, that the great truths of nature should be slowly brought to light at different periods, and sometimes by humble agencies. A vast amount of knowledge may exist on some subjects without being reduced to system, or classified under any general principle. It was so previous to the discovery of the law of the circulation of the blood, and of electricity, of magnetism, of chemical affinity, etc., etc. Should the inquiries that have now been started in this department of physiology, serve to bring out and establish any new principle or law applicable to a higher or more perfect development of animal life, its capacity and powers, where could there be a more ample field for the application of such principles or law,—one which gives greater promise of remuneration and success, than in the improvement of domestic stock? It will render more available not only all past experience and knowledge, but by infusing new light and furnishing a sure guide for future operations, will lead to most important and valuable results.

This law, instead of conflicting at all with past experience, harmonizes with almost every direction or rule laid down on the subject. It goes farther. It explains many questions which have baffled all inquiries, and reconciles many seeming contradictions which have been hitherto inexplicable. It furnishes great principles by which the correctness of all facts may be tested, and reduced to system. It helps to preserve all the knowledge which obtains upon the subject that is of value, and transmits it to others in a manner that can be turned to most valuable account. It points out the way whereby the surest and most important improvements can be made in domestic stock. And while it expounds the science

of breeding, it also furnishes a key by which every question, new or old, may be solved.

When the truth of this law is generally admitted, and its principles practically applied, language will fail in expressing the brilliancy or importance of its results. Guided by these principles, the science of breeding will be clothed with new interest, will be pursued in a more intelligent manner, and with a greater certainty of securing the desired objects. Under such auspices, may we not expect that the improvement of domestic animals will be more rapid, sure and permanent than it has ever hitherto been?

The Chairman. I am happy to say that we have a larger number of gentlemen here competent to discuss this question than could be collected, perhaps, in any meeting in New England, and we hope and expect that these gentlemen will not let their modesty govern them in this matter, but that they will take hold of this subject and give us their views in full, as far as possible. The question is now open for discussion, free to any one. I do not wish to call upon any individual personally, although I can do so if it becomes necessary. We hope to have a free-and-easy meeting. We want to have every man in this meeting feel at home, and understand that he is free to speak his mind.

Prof. Agassiz. I would like to say a few words upon this subject. I hardly dare to enter upon the discussion of the subject which as been so ably presented by Dr. Allen, and holding somewhat different views from those which he has expressed, I feel that perhaps this is not the proper place to present them; but as your president has said he hoped everyone would feel at liberty to express his opinions, perhaps I may be allowed to say a few words. But there is something beyond that. We have come here not only to exchange our opinions; we have come here to see if we can increase our real knowledge. We all agree upon those matters which are no longer matters of opinion, but which stand in the estimation of all as established truth, so far as we can reach; where we disagree, it is because we do not know enough to have really formed opinions. As soon as it is recognized that our disagreement arises from ignorance, and is not based on knowl-

edge, we are in a better position to talk. That is the thought I wanted to express first,—that everywhere differences, in matters of religion, in matters of politics, in matters of science, arise from our inability to know enough to agree with one another.

Now the subject before us is so wide that in fact it opens the whole field of human knowledge. Let me point out at once a few ranges of thought which have been suggested, which will show how wide the subject is. "Like begets like" is a proverb generally admitted, like an axiom. Well, it is founded on the generally received view that mankind is derived from one original pair. Now, if like begets like, why are there negroes? why are there Indians? why are there Australians? and why do we differ from them? We do not know, and that is the reason of our difference of opinion about that matter. And what is the fact with reference to the question of unity or diversity among men is equally a fact with reference to the animal kingdom. There was a time when naturalists seemed pretty well agreed in the opinion (not in the knowledge) that animals had been introduced upon earth with all their characteristic features, and that they had propagated, multiplied and spread over the earth, carrying with them all their characteristic features. Now, a majority of the naturalists, led by Darwin, than whom there is hardly another as able observer, hold that the whole animal world has originated from a few, say perhaps four original types, from which all have descended from successive transformations and changes. This does not look much like the generally received idea that "like begets like," but, on the contrary, it would seem to prove that like begets unlike, and that in order to have mankind upon earth, there must have been monkeys before; for the doctrine is now taught that we are descended from monkeys. But do we know it? Does Darwin know it? I believe not. It is an opinion, and there we differ, because of our ignorance. So, if I differ from you, Dr. Allen, do not think it is because I do not value the statements you have made, and so far as what you have said is a part of your knowledge, I believe we shall agree; but so far as it is your opinion expressed on questions which are not established by real investigation, we may differ and shall differ.

Now, what is it that we do not know in this matter of transmission? In the first place, we do not know the ancestry well enough. It is not only that there is this resemblance of the offspring to one or the other parent, but there is a mixture of the characteristics of the two parents in the offspring, for the three conditions obtain constantly. There is something else, something still more important. Children are not only the children of their father and mother, but they are the children of their grandfathers and grandmothers; they are the children of the generations preceding them; so much so that it is a well-established fact that very often children resemble their grandparents more than they resemble their parents. Here, then, we have a fact showing maintenance of character for more than one generation. Now, our ignorance is with reference to how long that uniformity is maintained. If the views that were entertained before Darwin propounded his opinions (for they are opinions) are at all correct, that uniformity obtains through all time. If his views are right, it is limited to a very remarkable extent; limited to such an extent as to show the probability of numerous changes, of changes, indeed, the result of which would be an introduction not only of different races, but of different species; not only of different species, but of different genera; not only of different genera, but of different classes of animals.

According to these views, a reptile must be the offspring of a fish. According to these views, a bird must be the offspring of a reptile. According to these views, mankind must be the offspring of quadrupeds, as quadrupeds are the offspring of birds. It will be conceded, I suppose, without any question, that the later animals must be the descendants of the earlier ones, if there is a succession of generations. Now, geology and paleontology, (that is, the knowledge we have of the animals which have existed in former times, and have followed one another,) show us that the classes of higher animals, not to take in the whole animal kingdom, have followed one another after this order: that fish existed before reptiles, reptiles before birds, birds before the mammalia, or quadrupeds, and that these existed before man. Now, if we are descended from monkeys, quadrupeds must be descended from birds, birds must be descended from reptiles, reptiles

must be descended from fish. Have we such information? No; and when I do not admit that animals are thus descended from one another, it is because I do not know how they originated, any more than Darwin does. It is a theory, perhaps. I do not believe it is as much as theory. I believe it is a brilliant expression of his magnificent imagination. And I will not disparage that faculty, for there is no science without imagination. Imagination is that powerful faculty with which we conceive of relations which are beyond the reach of our perception, through the senses, and without imagination there is no progress in science; but it is in proportion, as imagination is constantly controlled by experiment, by experience, by observation. Now, I know Darwin personally, and he knows himself, too; and early in his life, in his admirable narrative of his journey with Capt. Fitzroy around the world, in which he has disclosed so largely and so brilliantly that power of observation which is so eminently his characteristic, he closes that narrative, "The Journey of a Naturalist Round the World," with something like these words, which I cannot probably quite quote *verbatim*, but the sense, I know too well to misquote him: "That nothing is more profitable to a naturalist than travelling, on account of the varied impressions, and the varied opportunities afforded for observation; but the danger is in proportion to the opportunity. Seeing so many things in rapid succession leads to hasty conclusions, and passing from one hasty conclusion to another hasty conclusion, the result may be an entirely wrong view of the phenomena observed." The man who said that of himself at the close of his first really great scientific survey has furnished in his own life the evidence of his own propensity. It is hasty generalization on some well-observed facts; and that is Darwin all over. I do not think that I have expressed anything disparaging of his ability or his character, but I am satisfied that I estimate justly his tendencies, and that we find him constantly making generalizations for which there is hardly a shadow of a fact, the natural consequence of which is, in my opinion, that the idea of natural selection is entirely out of the question. But while I do not believe in this theory of the descent of all organized beings from a few primordial ancestors (and I will tell you why I do not believe at all in the idea of "natural selection,"

and of "the survival of the fittest"), it seems so very natural, it is Malthus all over, and it is so desirable, that it seemed to a practical Englishman almost a natural necessity. But let us see how it is. Do we find that only the strong beget families? Do we find that the children of apparently weak parents are always weaker than their parents? or that they are unfit to survive? I do not think that human experience goes that way. I do not think that in nature, under the broadest possible field of observation, we see anything like it. Let us observe, for instance, such plants as have a wide distribution. Let us observe them at the foot of a mountain range. We see, for instance, that our pine-trees at the foot of the White Mountains are stately, large trees. At a certain height upon the slope of the hill they are smaller; near the summit they are stunted shrubbery; and yet that stunted shrubbery has been in existence near the top of the mountains, ever since pines have been growing on the sides of the White Mountains, and they have propagated and multiplied in that condition just as well as the stately trees in the valley. It is a stunted, creeping sort of existence, but they have survived, and have had as long an existence as the strongest and largest in the lower part of the country. It is, therefore, sometimes a law of nature, that the weakest and apparently least fit are those that survive, as well as the strongest. Nature tells us, in that case,—and the cases might be multiplied,—that there is some reason why the weak may survive as well as the strong; some reason why those who to us appear less fitted, have as good a hold on life as those which appear to us more fitted. Why that should be we do not know, and it is probably because of our ignorance in this matter that there are those who deem that "natural selection" is the law of nature, and others who do not believe that the theory of "natural selection" has any value at all.

I do not mean to argue the question to its very bottom, and to consider the question of inheritance with reference to the origination of species, and all that. I meant only to make a few remarks in order to testify my dissent, a complete and radical dissent, from the views of Darwin, and to lead probably to a further discussion.

Mr. Lewis. You notified us, Mr. Chairman, that we were

to have a "free-and-easy" time. I am a sort of *slow* and easy man, but there is one difficulty in my mind, which prevents my acceptance of Darwin's theory of the origin of man. If like begets like, how did the monkey beget a man? And if like begets like, why not man beget a monkey? But the particular difficulty in my mind is this,—how the monkey, when he jumped from monkeyhood to manhood, left that long tail behind.

Prof. AGASSIZ. I will answer part of your question. The kind of monkey from which Darwin supposes that mankind is derived, had no tail at all. The gentleman has started one of the most interesting questions. The conformity of structure throughout the animal kingdom, is one of the most startling features in creation, and that conformity is so great that the ablest naturalists everywhere have demonstrated the fact by innumerable comparisons. At first, it would seem that in this configuration there are several striking differences, so far as form and general appearances are concerned; but when you begin to compare those individual parts in the changes they undergo with growth, you are led to recognize such a unity of organization, that the question may be, on the other side, what is the significance of the difference? And it is just that play on the opposite sides of the question, when it presents itself to our minds, which causes our progress in knowledge, and at the same time leads to those wide and marked differences in our estimation of things. Now, in the earlier condition of life, when the vertebral column is just forming, there are independent vertebræ sticking out from the outline of flesh in the human species, as well as in monkeys and all other animals, so that the embryo of the monkey, up to a certain period, and the human embryo of a corresponding period, will exhibit a condition of the extremity of the vertebral column as a caudal appendage, of exactly the same appearance, and exactly the same form. Why is it that in one these vertebræ become consolidated with one another, and remain as *Os Coccygis* at the lower end of the *Os sacrum*, and in monkeys increase in number, become movable, and form a real tail, we do not know; but the fact exists, that in some one condition of their growth, the two agree perfectly. The great problem is to account for the fact, that while there is this uniformity and blending, there are at the same time

these marked specific differences which constitute the characteristics of some animals. Now, if it can be shown that these characteristic differences are unchangeable, for an indefinite length of time, we can hardly admit at the same time that they are so changeable as to produce the differences we observe. You see that one excludes the other, and that whether or not there is some intermediate feature of which we are ignorant, which will explain it, there are marked and permanent differences, combined with uniformity of organization, which is the general feature. And that furnishes also the reason why we differ on so many topics; we observe a particular case, and fail to generalize so as to arrive at a law; for man is inclined by natural propensity, or by his natural organization, to jump at general conclusions, neglecting particular facts; and while we might agree if we went further, we disagree because we stop short of the whole.

Mr. Root. I dislike to raise this question, but it is one in which we, as practical farmers, are all interested. There is not a farmer here present who does not desire that he may know more and more how to perfect the character of his domestic animals, and having perfected it to a certain extent which may suit his wants, how to perpetuate and continue to have those wants met year after year in the rearing of his domestic animals. If we could have our scientific men of large research lay down some exact rules for our guidance from year to year, it is just what we would like; simplifying them, so that we may know just what course to pursue. We feel we have not had that exact teaching as yet. I hope this discussion will be entered into largely by all these practical farmers present. Various ways have been indicated by which we should preserve the excellence of our animals. Certain restrictions would seem to have been placed upon our breeding in particular directions. For instance, some will say that we should breed from thorough-bred stock, but that leaves us in this dilemma; we sometimes find that thorough-bred stock is not the stock which is absolutely necessary for us to have, for we must meet our yearly expenses. Why? Because we may find that some thorough-bred stock does not produce the amount of milk which we think we must have, and ought to have. This may not hold true of all the breeds, but it may

hold true of breeds which have not been kept up to that standard of excellence in some particulars which we want. They may have beauty of form, excellence of exterior shape; but the milking qualities may be decidedly wanting, and we feel compelled to use something else. Milk is what we all want. What course, then, shall we pursue? It is said, with great truthfulness, that like produces like, as as a law. A farmer may have a most excellent cow; he may couple that cow with a most excellent thorough-bred bull; and the progeny of that coupling may be an unfortunate one. There is no certainty in regard to it. It may be a poor milker. What I want is to have some course laid down whereby I shall feel a degree of certainty that when I couple my cow with something else, the progeny will be an exact reproduction of the cow. We have not arrived at that state yet. My own theory about it is this, which is perfectly in accordance with that of the lecturer who has so ably presented the question, that we must select such qualities in both animals as we want. If I have a cow of superior quality, I must inquire into her ancestry, and find whether, through a number of generations,—three, four, six or eight,—all these qualities have been nicely developed. If I find it so, then I have on that side the material for reproduction. Then it is equally necessary on the other side. If I find on the side of the male that for three, five or eight generations there has been a continued reproduction of the best milking stock, I feel then that on both sides I have just the elements combined together to give me good stock. I feel very sure of it. The trouble is with us; we are not careful enough in looking in both these directions as far back as we should. One of our neighbors, perhaps, has a thorough-bred bull. His pedigree in the book may be all right, so far as the book is concerned; the animal is rightly booked; his pedigree runs back very well; but so far as experience goes, he is a perfect failure. Why? Because, unfortunately, speculation has made rapid progress in this direction. A man who has thorough-bred stock which has cost him high to begin with, thinks he must make the best use he can of the material which he has to fill his pockets again. Every calf, male or female, from that stock, is raised. If some misfortune overtakes the animal when it becomes a cow, it makes no difference. It

may prove unhealthy, it may have been kept on bran and overfed, and grown up like a plant in the shade, so that it is not fit to raise stock from; it may look well enough; but all those elements which are so necessary to the proper development of an animal may be wanting. Here, I say, are some of the embarrassments which we farmers feel. Now, what course shall we take, what road shall we pursue to a higher and better state of things, in order that we may have a more perfect knowledge of what we shall do from year to year? I only rose to open the field in this direction.

The CHAIRMAN. We have a gentleman with us who has, perhaps, given as much attention to this single point of dairy farming as almost any one. I have great faith in his opinions, and I should like to hear him express those opinions upon this very important point at this time. I have reference to our worthy Secretary.

MR. FLINT. The members of the Board, and some other gentlemen present, will recollect that I discussed this subject at very considerable length at our last country meeting at Fall River, when I gave a lecture upon "The Principles of Breeding," and that I went over the ground pretty thoroughly. I am happy at the outset to express the high gratification and extreme interest with which I have listened to the lecture of Dr. Allen. It is one of the most interesting as well as, at the same time, one of the most complicated subjects that we, as practical farmers, have to deal with. It is difficult to make it perfectly clear; it is difficult to follow any lecture or any essay upon that subject. It depends very much upon principles, some of which are very well understood, others of which are still in the dark.

Now, I agree in the main with almost everything the lecturer has said, for it is a most admirable paper; but there are one or two points to which the Doctor alluded only incidentally which, it occurred to me, might usefully have been developed a little more fully. One was the fact that the hereditary power of an animal when properly bred is constantly cumulative. The lecturer alluded to it, and recognized it as an established principle, but it seems to me a matter of so much importance as to be worthy of a more prominent place.

Every farmer, in attempting to breed for the improvement

of his stock, ought to bear in mind that the hereditary power of the animal,—that is, the power of transmitting its qualities to its offspring,—is constantly cumulative; that is, if the animal has been properly bred. For example, the general law that like produces like is undoubtedly correct, upon general principles; the difficulty is in our want of knowledge as to the qualities and characteristics of the two animals which are brought together. They may appear to the eye to be alike, and yet there may be essential differences. If they are alike in all their essential peculiarities, the offspring will not only be like the parents, but will have their characteristics much more strongly marked; that is, the essential characteristics in which the parents are alike will be intensified in the offspring, and therefore the hereditary power of the offspring, that is, the power of transmitting its peculiar qualities, will become stronger and stronger. But if, on the other hand, the parents are not alike, if there are any essential differences between the male and the female, instead of this power becoming stronger and stronger with every successive generation, it will become weaker, it will become broken and very greatly reduced, so that you cannot depend upon it at all. We frequently hear a remark among farmers something like this: "I don't care anything about your pedigree. Let me see the animal, and I can tell whether I want to breed from him or not." Now, there is no greater mistake than that, for the reason that this hereditary power, this power of transmitting the peculiar qualities which we want in the offspring, is latent; is hidden in the system. You cannot detect it by the eye, you cannot detect it by any known law, except that of hereditary influence; pedigree, in other words.

And there comes in another difficulty. We cannot tell whether the pedigree of these two animals—the parents—is perfectly satisfactory or not. It may be as long as the moral law, and yet there may be breaks in it which have constantly reduced and weakened that hereditary power. If we knew positively the peculiar characteristics of all the ancestors of the animals that we are to breed from, then we could tell with some degree of certainty what the result would be; but the mere fact of a recorded pedigree is not worth anything unless we know the character of that ancestry,—unless we

know that in each case the male and female in each successive generation have been alike and of good quality. We have just heard that there are some monkeys with long tails, and some monkeys with stump tails. Now, if the male and female monkey are not alike, you do not expect to get a monkey like either of his parents; necessarily, you get something which is unlike those parents. The offspring is not like the parents, simply because the parents were not alike themselves.

I might illustrate this, perhaps, in a way which would bring it to the practical knowledge of every man a little more definitely in this way: We might suppose that a certain male, after a certain number of generations, has the hereditary power strongly concentrated in his system. If he is the offspring of parents, grandparents and great-grandparents which have been alike in both cases, he has the hereditary power—that is, the power of transmitting his qualities, very strongly marked and intensified in his system—more strongly than it was in his parents, grandparents or great-grandparents. Now, suppose the power which this male animal has of transmitting his essential qualities to his offspring could be represented to the eye. This power has a money-value in breeding. Let us suppose it could be represented to the eye. Suppose, for instance, we call his hereditary power equal to 100. Now, suppose the female to which he is put has been bred differently; suppose she has been cross-bred, just as the common stock of the country, or what we call native sheep, have been bred, without any system, without any care to couple animals which are absolutely and essentially alike; of course the hereditary power of that female will be very much less than the hereditary power of the male, because the hereditary line—the power of transmitting qualities—has been broken, and has been greatly reduced. We will suppose, for instance, that her power of hereditary transmission—her power of transmitting her qualities, her peculiar characteristics, to her offspring, is only 60 instead of 100. Now, these two animals are coupled together. What is the offspring? The offspring will possess a hereditary power not like its male parent; it will possess a hereditary power—that is, a power of transmitting its characteristics to its offspring—not represented by the 100, not

represented by the 60, the value of the hereditary power of its mother, but by a number perhaps somewhere intermediate between them; it would be difficult to tell exactly what. I do not mean to say that there is any law which will represent it exactly. I merely give this as an illustration to show you how greatly the hereditary power is constantly reduced when the parents are not alike. I say that in such a case as that, you could represent the hereditary power of the offspring of such parents, not by 100—the hereditary power of its father—nor by 60—the hereditary power of its mother—but it would be a power very greatly reduced.

Now, that fact ought to be borne in mind; and it ought also to be borne in mind that this hereditary power is strictly latent and hidden in the system. Take, for instance, what is called a thorough-bred animal, a bull or a ram. You put that bull or ram upon a female which has been bred as I have said, without any care or system, the merest haphazard, and what do you get? You get an offspring which will be almost precisely, to the eye, like the father. Why? Because the hereditary power of transmission in the father was so concentrated that he transmits, so far as the form is concerned, most perfectly, completely, that form to his offspring. But now you must bear in mind, that although that form is so attractive to the eye, although it fills the eye so well, yet the hereditary power of its father is gone. Now, look at that remark, "Let me see the animal, and I can tell whether I want to breed from him or not." You see how fallacious it is. There is nothing more fallacious than to judge merely by the eye. It ought to be known how strong the power of transmitting its qualities is. And that very fact which I suggested is practically admitted by every farmer, in this way: after an animal, a bull for instance, or a horse, gets to be six, seven or eight years old, then you see what its offspring is; you see what it gets; but by knowing positively, by knowing clearly and fully the amount of hereditary power which has been accumulated in the animal, we ought to be able to judge before that time; we ought to be able to judge when the animal is young.

A few years ago I had a flock of sheep. They were not natives, but graded sheep. They were evidently grade Cotswolds with a little Irish Smut, perhaps, and possibly a very

little Southdown. I bought them for a particular purpose, to reduce and improve an old rocky, bushy pasture. I did not buy them for the wool particularly; that was an incidental matter entirely. But while I was reducing and improving that pasture by means of those sheep, I thought I might just as well improve the sheep a little, and so I bought as good a Southdown ram as I could get; I have no doubt he was pure-bred. I put him in with this flock. The next year most of the lambs were so much like Southdowns, so thoroughly marked, that it would have been difficult to tell them from pure-bred Southdowns. They had all the characteristics, so far as you could judge by the eye, of their father,—black feet, black faces, and black legs, etc.,—and their wool was very similar. Hardly any of them took after their mothers, because their mothers were all grade, or low-bred, common sheep. I do not know that there was one of them that was not very strongly and distinctly marked after the father. Well, suppose any neighbor had come and wanted to buy a ram to breed from. I could not have recommended one of those lambs, although they looked about as well as their father, but I suppose I might have sold them for pure-bred Southdowns, they looked so well, but they would have been worth not much more than one-third what their father was as a breeder, simply because they had not that hereditary power accumulated in their system; they could not have been depended upon at all. They might have transmitted their peculiarities, but the chances were they would not; and that is no way to breed.

Now, I say that farmers should bear in mind that this hereditary power, which is so valuable and important, and on which our whole improvement must depend, is hidden, latent, cannot be detected by the eye. That shows the value of a good pedigree; but not merely a recorded, written pedigree. It must be a full pedigree, such as to guarantee the quality of the ancestry. The pedigree ought to be studied in each case, and in that way, and in that way alone, can we breed with any degree of system, or any degree of certainty in regard to the result.

I want very much to hear these questions discussed by the practical farmers and dairymen in this section, who, I am

sure, are very much interested in this subject, and for that reason I am sorry I have occupied so much time.

Mr. WETHERELL. I would like to make a remark upon this question of hereditary descent. One of the best experiments in breeding that has ever been made in this country was made by Mr. Hammond, of Vermont, in breeding merino sheep, what we call the high-priced, best quality of breeding merinos. Mr. Hammond told me with regard to that particular branch of farm stock, that he had already attained a very high quality, and in order to continue to improve, when he had a ram lamb dropped that he thought came nearer to his ideal than any other, he always marked that lamb, and put him aside for further improvement; but before starting to breeding generally from that lamb, he would examine him thoroughly, and then look over his ewe lambs and see with which of them that ram would best cross, and after letting him serve one or two, or perhaps three, for the purpose of testing him, he used him no further that year, but waited until the lambs were dropped to see what the result was; and he said that in a great many cases he was wholly disappointed, and used that ram no more for that purpose, but put him into the flock to be sold with the others, as a thorough-bred ram; he did not say that, but I may say it. Then he took another ram and tested him in the same way, "until," said he, "by and by, I would find a ram which would cross exactly with the ewe I wanted, and then I had taken one step in the line of progress which I desire to make." "In that way," said Mr. Hammond, in a prolonged discussion, "I made constant improvements in my stock from lambs which I had in my own flock." In that way I think a principle, or a practice was developed, which farmers too often overlook. You have undoubtedly heard it said, as I have frequently, that a particular ram, or bull, or stallion is pure-bred, without knowing anything further about the animal, and he is sold as a stock animal; whereas, he may prove very imperfect; his get may be the opposite of what you desired. Now, I think that this principle lies at the foundation of stock breeding. I have here in connection with this subject, a fact which I wish to present from one of the best breeders in England. I think that my friend, Dr. Allen, to whose address I listened with a

great deal of interest, did not go back far enough in his account of the improvement of stock in England. I think it dates back more than one century, as it regards particularly the Shorthorn branch of the cattle family. Be this as it may, however, the fact which I will give you, will show an animal bred longer than the period named.

Mr. Thomas Bates said of his branch of the improved Shorthorn family: "Wherever they are fairly tried, their merits will shine forth in producing a greater return for the food consumed than any other breed of cattle that was ever known. Charles Colling, of whom I got them, repeatedly assured me that the first cow he bought of the Duchess breed was the best cow he ever had or ever saw, and that this first cow was better than any he could produce from her, though put to his best bulls, which improved all his other cattle. These cattle were in possession of Sir Hugh Smithson's family for two centuries, and their celebrity was kept up by paying attention to their breeding. Charles Colling," adds Mr. Bates, "bought this tribe in 1784, and in 1804 I (Mr. Bates) purchased my first Duchess cow of Charles Colling, my bull, 'Kelton,' by 'Favorite,' then in her womb. This cow calved June 7, 1807, and was kept on grass only, in a pasture with nineteen other cows, and made, in butter and milk, for some months, above two guineas per week. Duchess 34th (the dam of the four Dukes of Northumberland bulls) consumed one-third less feed than my first Duchess (purchased in 1804), and her milk yielded one-third more butter for every quart of milk, and while the consumption of feed was one-third less, and the milk yielded one-third more butter; there was also greater growth of carcase, with an increased aptitude to fatten. This cow in her thirteenth year had had ten calves. If these be not proofs of excellence, then let Shorthorn breeders say what are, and where the like can be found."

I think the farmers here will agree with me, as they will in central New York, where my friend Lewis comes from, that this Duchess family, to which allusion is here made by Mr. Bates, has done more to improve the milking stock than any other family of the cattle kind that has been introduced into this country. I think that these facts touching excellency of breeding are of interest; and yet I think, as I

before said, that our friend cannot tell how it can be done every time. There are conditions, there are circumstances of which we are ignorant, and it seems to me we must ever remain so, so far as regards producing constant and exact results.

Mr. Holland. If I understand Mr. Flint correctly, the elements of transmission were very weak on the side of his ewes, and very strong on the side of his ram; and, as I understand it, by the cross he made he got some very superior lambs. Now, if we reduce this power on the female side, and get an animal that has a very strong power on the male side, why isn't the assurance still stronger that we are going to get what we want for the time being?

Mr. Flint. You can breed in that way for the butcher to very great advantage, but my idea was that in selecting a breeding animal, we ought to take care to see that this hereditary power is strongly intensified in the system. If you are breeding for the butcher, that cross would be just the right cross. If you use a Shorthorn bull on what we call a native or grade cow, you get a better calf for the butcher than the cow was naturally, because early maturity, rapid growth and large accumulation of muscle in proportion to food consumed, are among the strongest characteristics that are accumulated in the system of the Shorthorn bull, and these points are very weak in the native or common cow. Now, I say, if you want to breed for the butcher, there is no better way than that; but if you want to breed for constant improvement of breeding stock, it is very desirable that you should study to obtain a like character in both the male and female. Then, if the parents are alike, the point I made was the power of transmitting those qualities to the offspring was strengthened. If the parents were unlike,—if one had very strong power of hereditary transmission and the other a very weak one,—then you got offspring like the one that had the strongest power of transmission. If that strength was accumulated on the part of the male, you got in the offspring the likeness of the male, especially in external form. If that power of transmission is accumulated in the female, then you will have an offspring that will resemble the female in external form; that is, the offspring will take after the parent that

possesses the strongest blood, as we say, or the strongest power of transmission.

But there is no advantage in using a low-bred animal on either side if it can be avoided, because, supposing you have an equally strong accumulation of good qualities in the male and the female, then you get not only this perfection of form, but you also get an offspring which will correspond to the parents, and consequently will be much more valuable on that account. There is one advantage which the farmer has in breeding from pure stock, that the offspring,—the calves, the lambs or the pigs, whatever they are,—will be worth so much more, and will command so much more money. It is so much addition to the annual income.

Mr. Wetherell. Why is it that in using a thorough-bred Shorthorn bull upon a low type of what is called the native cow, or stock without pedigree, that the progeny from that cow will often outweigh, for beef purposes, an animal begotten from a grade heifer or a half-blood. Why is it that in the New York market grade stock often sells better than the pure-bred stock?

Mr. Flint. The mother of the offspring,—the common cow,—is ordinarily a better milker than the pure-bred mother, particularly in that breed. Now, a mother that is a large milker will produce a calf that will grow faster and often make a larger and better animal than a calf from a pure-bred cow; therefore I say that when breeding for large and valuable calves it is often wise to breed from a grade or common cow, if she is a large milker, with a pure-bred Shorthorn bull, than from a higher bred cow, when the object is to raise animals for the butcher.

The Chairman. I have been requested to call upon a gentleman who is not at present a member of the Board, but who I understand is a coming member of the Board; and that is, Dr. Wakefield, of Monson; and as they say "there is safety in a multitude of counsellors," I presume he will assist Dr. Allen and Prof. Agassiz on that point.

Dr. Wakefield, of Monson. It has been stated here that there are different kinds of monkeys, and there are different kinds of men. There are the long-winded and the short-

winded. I belong to the short-winded class now, because I have a very bad cold, and if I should seem likely to get into the other class, of long-winded, you, Mr. Chairman, are there to call me to order. My main purpose in coming here was to hear my friend Dr. Allen, because I have known him for a long time, and knowing the great interest he has felt in this subject, knew that he would discuss it ably, and I have been exceedingly interested, as every other gentleman who has heard him here to-day has been. It has been said by Prof. Agassiz that we differ because we are ignorant. Now, in my ignorance, I can tell you what I have done, and if you can profit from it, whether it is bad or good, you will have the advantage.

I have the care of one of the farms belonging to the State. I went on to it by an order from His Excellency Gov. Bullock, about five years ago. I found it then keeping about twenty-five cows,—natives, grade Ayrshires, and grade Short-horns. I now have about forty cows, and every time I milk them, I have about four hundred mouths ready to open and swallow every drop of it. The question with me was, how I could make the most out of those twenty-five or forty cows; how best I could fill those four or five hundred mouths. The first thing I determined upon was to take a record of every cow, and see how much she gave at every milking, and then I should know whether she was a good or a poor one. I had four different kinds,—three grades and the natives. I numbered my cows, Nos. 1, 2, and so on. I have a man who takes charge of the milk, and he puts down the quantity against each number, and every night he brings the record to my office. I know every day what each particular cow gives, and if there is a falling off of one or two quarts, I can inquire what is the matter with that cow, or why she is shrinking in her milk. At the close of every month a report is brought to me, and I know what each cow has given during the month; and at the close of the year I know what each cow in the herd, and what the whole herd have given for the year. After looking at this subject about two years, I became satisfied that grade Ayrshires were giving me more milk, in proportion to the amount of food consumed, than any other animals we had. We do not make butter; we do not make

cheese, except to this extent: we furnish our young children, and our sickly children, with the milk as it comes from the cow, warm, and then we set enough of that away for about ten or twelve hours to get cream enough to make butter for our family. I have bought but a very few pounds of butter since I have been here, for a family of about forty employés. I decided that it was best for my purpose to get into grade Ayrshires or Ayrshire cows as quick as I could. How should I do it? Although I had the State's money to buy stock with, they would not justify me in going to Scotland, or going to New York, and paying five hundred or a thousand dollars for a sire or a cow. I had therefore to look around and do the best I could here. I accordingly made up my mind that we must have a thorough-bred Ayrshire bull, and I looked around through the Commonwealth, and some out of the Commonwealth, and selected one that I thought was as good a pattern as I had ever seen, and he cost me one hundred and forty dollars. I have used him for the last year, and I am now raising grade Ayrshires from him. About two years ago I bought two thorough-bred Ayrshire cows, paying two hundred and fifty dollars for one, and one hundred and fifty dollars for the other; that was the extent to which I could go.

Now, whether that strain, either on the male side or the female side, was the best milking strain of the Ayrshires, I do not know, and I did not know about the purity of the stock, only I took it from the Ayrshire Herd-Book. I suppose that to be good authority; if that is not authority, I do not know what is. A gentleman shakes his head. I do not know as it is; but if it is not, what is better? I have no doubt there are strains of blood in that book which should not be there; but that is the standard authority, and I do not know any better. I got the best milkers I could find for the price I could give. I have kept along through the year, until within the last three months I have had a chance to buy six more cows, and I have availed myself of it. Some of them were from the Sweetser stock, and some from the Loomis stock of Connecticut, and I got them at prices with which I was satisfied. Since I have determined to go into that, wherever I could find a good grade Ayrshire I have bought her, if the price was within the means I could command, and I have

got the best cows I could in the region. Now I have, as I stated, a herd of forty cows. Our year commences with the first of October,—that is the time when we make our annual report to the legislature,—and these cows gave me last year twenty-eight thousand and odd gallons, and I make that twenty-eight hundred and seventeen quarts to the cow. The majority of them are grade Ayrshires, but I have some natives, and I have a few Shorthorn grades. I have two or three Jersey grades, which are very good cows. I do not expect to get much better ones. The lowest yield has been seventeen hundred quarts, and why that cow did not give more this year, I do not know. I have not sent her to the butcher, because I was in hopes there was power in her yet; but my idea has been, when my cows fell down in that region, they had better go to the butcher than stay for milkers. I do not suppose that I have got any such herd as the gentleman who spoke to us last night. All I judge from is the amount of milk they give. In regard to the butter, all I can say is that the cream makes pretty decent butter, as those gentlemen present who have ever been there can testify, because they have never eaten anything that was bought for them. If we had any good butter there we made it. Now, I propose to get from those cows, by this bull that I bought, the best stock I can, and whenever I find that anybody else has a cow which is superior to them, I mean to get her, if her price is within my means. That is the way, in my ignorance, I have been operating, and that is the result. I tried the experiment until I was clear in my mind. It was an opinion, I know, but it was a decided opinion, almost coming up, I think, to what Professor Agassiz would call knowledge on the subject, that the best thing I could do was to go into Ayrshire stock, and I have tried to do so as fast as I could, and that is the result. That has been my experience.

I agree with what has been said as to the great importance of the subject to every farmer, and it is important to those who are making milk as well as those who are making beef, to look at this subject and see what it is best to do. Now, if I have erred in this, you have the benefit of it, and if there is any advantage in it, you may have the advantage also. I was

16

not aware that I had spoken so long, and I am afraid I have run into that other class of men of whom I spoke.

Mr. Root. I know from observation that the Doctor has a splendid herd of cattle, and I think it would be interesting if he would state his method of feeding.

Dr. Wakefield. I believe with Mr. Lewis here, that the very best thing for cows is grass, and when you cannot have green grass, I think dried grass is far better than hay. We cut on our farm this year, about a hundred and eighty-seven tons of grass, reckoning about fifteen tons of Hungarian grass, and it is almost all good grass. We had not pasture enough to carry those cows, and I fed them every day from the barn one foddering of good hay, with perhaps two quarts of middlings. This is what they have in the summer. The grass in our pastures does not get very high, we have to pasture them so close, and I thought they must have something else, because my experience has been that you can never make a cow give a large quantity of milk, if you do not give her enough to eat. If you would have a full flow of milk, your cows must have full feed, so I have fed them every day, as I have said. I calculate to cut my hay so as to get it as soon as I can after it has blossomed. We begin before it has all blossomed, because we have to, and if we have such seasons as we had this year, we cannot get through until after some of it is a little turned, but we did very well. I think I never got my hay in better than I have this year, but it has cost a great deal of labor. We had to get the hay into the barn, and when the sun came through the clouds, we would hold it out on pitchforks. That is about the way we did it; but it has turned out pretty good hay. I calculate to raise roots enough to give every cow that is giving milk through the winter a fodder of roots every day, from the time she comes into the barn until she goes to the pasture. She does not always get, as my friend here says, a peck, but she always has some; but we give them the best hay we can, and give them all they will eat. We have to feed them more than twice a day, because we have not come up to the Barre standard of feeding twice a day. I have seen Mr. Ellsworth's herd after they had been fed, and they were standing there with a great deal of composure. I have no doubt if they had

been lying down, we should have found them very "free-and-easy."

Dr. Brown. At this late hour I will take but a moment. I want to say how much interested I was in hearing the paper of our friend Dr. Allen, and I hope I shall have an opportunity to read it. I mean to read it and to study its principles. I do not propose to go into these questions now, but I have been placed where I have seen some of the results of hereditary influence. I want to make only one slashing criticism. You know, if you have read Mr. Allen's previous papers which he has given to the public, that he speaks of the disgrace of the speculative element which has entered into the breeding of cattle, and cites some of the influences which tend to that; and among others, the fashion of the day. Now, it is the fashion of some men, who have a great deal of money to spare, to get very fine-looking stock, and the breeders look to that rather than to utility. What the farmers of Barre want is cows that shall pay their expenses in the form of milk. I merely want to state in reference to an idea that has been thrown out in relation to the Duchess stock, that I had at one time occasion to visit the farms of Mr. Sheldon, in Geneva, and Mr. Cochran, in Quebec, at which these experiments were represented to have been made, and I will merely say that I was told they had been carried on until the cows will not give milk enough to raise their own calves.

Dr. Sturtevant. I wish to correct one impression which I think ought to be corrected. It is against the improvement of our stock to have the idea go abroad that unusually high prices are demanded for thorough-bred cattle. I would like to ask the gentleman what breeder of Ayrshires charges him from five hundred to one thousand dollars for a bull or cow, and what breeder would call two hundred and fifty dollars a low price for a good cow? I think that the cases where over five hundred dollars are paid are very rare indeed. The price has never struck one thousand dollars but once, to my knowledge. One cow, remarkable for its superior beauty and excellence, was sold for one thousand dollars. Two hundred and fifty dollars will buy the very best Ayrshire stock, with a good pedigree,—a pedigree that will bear examination. If you want to get a show animal, you have to meet an active compe-

tition, and pay a large price; but if you want value for the farmer, two hundred and fifty dollars will buy the best and one hundred and fifty dollars will buy a very good cow.

Dr. ALLEN. The more I investigate this subject, the more I see how complicated it is. We cannot understand all these points at present. The only way is to agitate, discuss and investigate, and follow up those great principles of physiology. They are the groundwork, the guiding principles which we have to act upon. Experiments, observation, individual facts of experience, are all good; but let us go back to the great principles, and stick to them year after year, generation after generation. That is the only way in which we can settle these points, and perhaps we may never be able to settle all of them.

I wish to correct one impression. Professor Agassiz seems to infer from what I said that I agree with Darwin in his theory in regard to the origin of species. I disclaim that entirely. I do not agree with his theory as to the origin of species or the descent of man, but we may glean principles and facts from his writings, and make use of them to settle other great principles and laws, and still not be advocates or believers in some of his doctrines.

I am much obliged to the gentlemen for listening to me, and for the opportunity they have given me to address the Board of Agriculture.

Adjourned to two o'clock.

AFTERNOON SESSION.

The Board reassembled at two o'clock to listen to a lecture upon

PRACTICAL QUESTIONS OF LAW RELATING TO FARM PROPERTY.

BY FARWELL F. FAY, OF ATHOL.

It would be impossible, in a single hour, to present for your consideration all of the various and important legal questions that grow out of the rights of property, and discuss them in an intelligent manner.

I shall content myself by attempting to offer a few thoughts

and discuss a few questions only which seem to me the most practical in their relations, and the most deeply to affect the interests of the farmer, as regards his right to hold property in this Commonwealth.

For the purposes of this examination, I shall assume that the farmer has in his possession an instrument which conveys to him certain real estate therein described, and having such an instrument in possession, by the description therein contained is to be determined the extent of the grant. A conveyance of the land carries with it all crops and trees growing and standing upon the land, and all the buildings standing thereon, whether specifically defined or not, unless an express reservation is made in the deed of conveyance. If there are crops, trees or buildings standing upon the land, the title to which is in third persons, such persons will not be divested of any legal title they have in them, by virtue of the conveyance from the owner of the soil; and although no title will pass to the grantee in the deed, yet the grantor will be liable for damages on the covenants in his deed; and oral evidence will be inadmissible to show an agreement that the trees and buildings standing upon land conveyed by an absolute deed were not to pass.

BOUNDARIES.

The boundaries become important in determining the amount of land conveyed, or the extent of the grant. Where a deed describes land by its admeasurements, and at the same time by known and visible monuments, the latter will govern, unless it clearly appears that such monuments were inadvertently inserted, and that a tract of land with different boundaries was bargained for, and intended to be conveyed. And although the rule that monuments control courses and distances has long been regarded as one of the fundamental rules in the construction of deeds, yet the reason given is that the former are less liable to mistakes; if then it appears that no mistake can reasonably be supposed to have been made, no reason remains for the application of the rule. Where a conveyance refers for a boundary to a monument not then actually existing, and the same is afterwards erected, it will govern and determine the extent of the land, notwithstanding it vary slightly from the line laid down in the deed.

And where the *quantity* of land is mentioned, in addition to a description of the boundaries, without any express covenant that the land contains *that* quantity, the whole will be considered as mere description, and the quantity must yield to the location by certain boundaries.

But if there be a map or plan of the land, upon which the lines are laid down, and the map or plan be referred to in the deed, it becomes as much the true description of the land conveyed as though it had been incorporated by a recital in express terms in the deed.

And where a line is described as measuring a certain number of feet, "more or less," and there is nothing in the description given in the deed or in the subject to which it applies, to explain it, the number of feet mentioned is to be the precise length of the boundary line.

A boundary from one bound to another is to be regarded as a straight line, unless a different one is defined in the deed; so a line which is defined by the location of a Virginia fence, is held to be a straight line extending through the centre of the fence.

When a conveyance of land is made which adjoins a stream of water, a highway or a building or structure, it often becomes important to know whether the boundary line extends to the centre or side of the object named.

Generally, a deed of land bounded "by," "on," or "upon" a highway conveys the land, subject to the public easement, to the centre of the highway. But where the boundary line in a deed begins at a stake "on the side" of a highway, and thence by various courses and distances to said road or highway, thence by said highway to the place of beginning, no part of the road is included; and where the deed bounds land "on a road," but metes and bounds are also defined which plainly exclude the road, no part of the road passes.

A boundary of land to a highway, thence "upon" said highway, passes the land to the centre, although the length of the line given carries it only to the side of the highway,—unless there is a fixed *monument* on the side of said highway.

If a grantor of land, bounded on a *private* way, owns both sides of said private way, a conveyance "by" or "on" the

same carries the land to the centre, the same precisely as if bounded on a public highway. If the conveyance bounds by the side of the way, as the "east side" or "west side," no part of the way passes.

In the language of the supreme court, we find that whether any grant extends to the side line or the centre line of a highway or stream of water, is doubtless a question of construction in each particular case, and depends, as in all other cases, upon the intent of the parties as expressed in the descriptive parts of the deed, explained and illustrated by all the other parts of the conveyance, and by the localities and subject-matter to which it applies. The owner of land by the side of a highway, and under it, to the centre thereof, may of course, by using apt words, limit his grant to the *edge* of the highway, and retain his title in the fee of the soil over which the highway runs. But in the absence of words clearly manifesting an intent so to do, the law presumes that he did not intend to reserve the title in a strip of land not capable of any substantial or beneficial use by him, after having parted with the land by the side of it, while the highway remains, nor ordinarily of any considerable value to him, if the way should be discontinued; and the ownership by him might greatly embarrass the use or disposal, by his grantee, of the estate granted.

And the same construction is given to the words "by," "on," and "upon," when used in defining the boundaries of land bordering on "streams of water," as when used with reference to boundaries on "ways." The centre of the stream has been held to be the true boundary line of land conveyed by a deed describing it as bounded on said stream, and where there has been an "artificial pond" created, the thread of which continues to be apparent through the pond, a deed bounding "by the pond" conveys the land to the thread of the stream.

If an "island" gradually arises above the surface in a river, and becomes valuable for use as land, and it is so situated that it is partly on one side and partly on the other side of the thread of the river, it shall be divided by that line which was the thread of the river immediately before the rise of the island, and in that manner be held in severalty by the adjacent

owners; but if one portion of the island approaches nearer to one side of a stream than it does to the other, the greater part belongs to the owner of the nearer estate according to its approximation thereto.

And this is so whether the island has been formed by gradual deposits from the river or by some sudden division of the river, unless the owner of one side or the other of the river should be able to show that it was created by a disruption of his land.

Not unfrequently land is bounded by a building, or the side of a building standing upon the adjoining land; and it has been held that a boundary "by a house" conveys the land only to the "edge of the eaves."

FENCES.

Having now considered the most important questions concerning the construction given to the words and phrases ordinarily used in conveyances to determine the quantity and boundaries of the estate, we will now inquire as to the rights and liabilities of the owners of lands as regards fences.

By the General Statutes of the Commonwealth it is provided that "fences four feet high and in good repair, consisting of rails, timber, boards or stone, and brooks, rivers, ponds, creeks, ditches and hedges or other things, which the fence viewers within whose jurisdiction the same shall lie shall consider equivalent thereto, shall be deemed legal and sufficient fences. The statutes also provide that the respective occupants of lands inclosed with fences, shall, so long as both parties improve the same, keep up and maintain partition fences between their own and the next adjoining inclosures in equal shares.

Towns are required annually to elect "fence viewers," and by application to them, provision is made how and in what manner delinquent owners may be compelled to make their share of the division fence, or to pay for such share when built by order of fence viewers by the adjoining owner.

The rights and duties of the fence viewers are created wholly by statute; and it is essential that the provisions of the statutes should be carefully and strictly regarded; their

powers cannot be enlarged beyond a fair and strict construction of the statutes conferring the power.

An owner of land may be released from obligation to maintain division fences when he ceases to improve his lands and chooses to let them lie in common. In the event that he *has* been obliged to maintain a fence, and ceases to improve his lands, a notice of six months to the adjoining owners, according to the statute provisions, becomes necessary in order to free himself from the obligation to repair.

These familiar principles respecting rights of owners in and liabilities of owners to maintain division fences are so particularly set forth in the General Statutes, it is idle to more than refer to them. But there are some questions that are not referred to in the statutes, that demand attention. There is in this Commonwealth no obligation imposed upon the owners of land to fence against the public highways, and if a person is injured in his land by beasts of any description belonging to another, which escape upon his land from a highway adjoining, either because there was no fence or because the fence was insufficient, he may recover his damage in an action of tort against the owner of said beasts. If they escape over a "division fence" which was insufficient and that insufficiency was caused by the neglect of the person who claims to have been injured to maintain his part of the division fence, the owner of the beasts is not liable for any damages they may have done.

I know of no principle that excuses the owner of beasts from the liability to pay for all damage that they may do to the crops or lands of another, unless such damage is the result of their escape over the division fence, which by law the owner of the land was obliged to keep in repair, but which he had suffered to get out of repair, and even then a distinction is made, and in order to excuse the owner of the beasts it must appear that they were *lawfully* on the adjoining land. For instance, suppose that the cattle of A. from any cause, escape from his land upon the land of B. and thence from B's land, to the land of C., where they do injury to his lands. Now the fact that in escaping from B's land they escaped therefrom in consequence of the insufficiency o the fence, which C. was bound to keep in repair, does not avail A. so as

to excuse him from his liability to pay C. the damages occasioned thereby.

The owner of land has a right to erect one-half of a partition fence of reasonable dimensions on the land of the adjoining owner, and in its erection, if more than one-half is built upon the land of the adjoining owner without his consent, he may remove the excess, and if in order to effect such removal it becomes necessary to take down the whole fence, he may rightfully do so; and whenever a "ditch" is a proper fence, the owner of land may construct one-half of a ditch of reasonable dimensions on the land of adjoining owners.

The whole law may be generally summed up, by saying that "the owner of cattle is bound at his peril to restrain them from trespassing upon the lands of his neighbor."

SURFACE WATER.

To what extent the owner of land has a right to turn the surface water on his land upon the land of an adjoining owner, or how far he has a right to prevent it from coming upon his land from the adjoining land, has received considerable attention, and the law seems well settled. The right of an owner of land to occupy and improve it in such manner and for such purposes as he may see fit, either by changing the surface, or the erection of buildings or other structures thereon, is not restricted or modified by the fact that his own land is so situated with reference to that of adjoining owners that an alteration in the mode of its improvement or occupation in any portion of it will cause water which may accumulate thereon by rains and snows falling on its surface or flowing on to it over the surface of adjacent lots, either to stand in unusual quantities on other adjacent lands, or pass into and over the same in greater quantities or in other directions than they were accustomed to flow. Where there is *no water-course* by grant or prescription, and no stipulation exists between conterminous proprietors of land concerning the mode in which their respective parcels shall be occupied and improved, no right to regulate or control the *surface* drainage of water can be asserted by the owner of one lot over that of his neighbors.

The legal maxim—"*cujus est solum, ejus est, usque ad cœlum,*" "he who possesses land possesses also that which is

above it,"—is established as a general rule, applicable to the use and enjoyment of real property, and the right of a party to the free and unfettered control of his own land, above, upon and beneath the surface, cannot be interfered with or restrained by any considerations of injury to others, which may be occasioned by the flow of mere surface water in consequence of the lawful appropriation of land by its owner to a particular use or mode of enjoyment.

Nor is it at all material in the application of this principle of law, whether a party obstructs or changes the direction and flow of surface water by preventing it from coming within the limits of his land, or by erecting barriers or changing the level of the soil, so as to turn it off in a new course after it has come within his boundaries.

So that the obstruction of surface water or an alteration in the flow of it affords no cause of action in behalf of a person who may suffer loss or detriment therefrom against one who does no act inconsistent with the due exercise of dominion over his own soil. A party may improve any portion of his land, although he may thereby cause the surface water flowing thereon, whencesoever it may come, to pass off in a different direction and in larger quantities than previously.

If such an act injures the land adjoining, the owner thereof has no remedy for damage.

There can be no doubt in the application of the rule that it applies to land naturally wet and swampy. Any adjacent owner of land may raise his land by grading or filling so as to prevent the flow of surface water from the adjoining estate upon his land, and it makes no difference that it has been accustomed thus to flow for a long term of years.

The supreme court of this Commonwealth asserts the principle, "that no length of time creates an easement by which the owner of the lower lot is precluded from using his own land as he will, although the *natural* overflow of water may be thereby stopped and set back upon the upper estate.

In a recent case in Rhode Island, in which the right of surface drainage for agricultural purposes was a subject for discussion, the learned chief justice said: "Water, whether it has fallen as rain, or has come from the overflow of a pond, or swamp, which sinks into the top soil, and struggles through

it, following no defined channel, is deemed by the law absolutely to belong to the owner of the land upon which it is found, for the avowed purpose of enabling him to cultivate his land, by controlling or draining it off in the mode most convenient to him; and it is not affected by any right in the owner of an adjoining river, pond or tank, which it may chance for the time to feed, though that time be ever so long protracted. It is not water in a water-course, or in an infinitesimal number of minute water-courses, in the sense of being obedient to the law regulating the use of water flowing in such defined natural channels; but is in the eye of the law, as well as of common sense, the moisture, and a part of the soil with which it intermingles to be there *used* by the owner of the soil, if to his advantage, or to be *got rid of* in any way he pleases, if to his detriment."

Town officers are now authorized by statute in this Commonwealth to lay out suitable drains across the land next to and adjoining highways, by establishing the same by metes and bounds, courses and distances, similar to the location of town ways, and the question occurs, What right have the town authorities to construct drains or culverts at common law, and beyond or in addition to this statute right? No doubt exists as to their right to construct them within the limits of the highways; and if in consequence of such construction the surface water collects and forces itself upon the land of the adjoining owner, it has been held to give him no right of action, inasmuch as that should have entered into the elements of damage, when he was awarded damages for the laying out, lowering or altering said highway, as one of the incidents necessarily pertaining to it.

And on the other hand, if the said owner of land can prevent the flowing of the surface water upon his land through the drain or culvert so built on a highway, either by raising the surface of his own land or by stopping up the mouth of the culvert, he may do so without laying himself liable to an action, provided he can do it upon the limits of his own land, and then the surface water must be disposed of in some other way. The reason of the rule is, that one individual cannot acquire any such right to turn surface water over the land of another, and if one who owns the fee has no such right, there

is no reason why the public, who own only an easement over the land, should thus acquire it. But the mere right of drainage over the general surface of land, is very different from the right to the flow of a stream or brook across the premises of another.

It has been observed that it is only when the flow of water on one person's land is identified with that on his neighbor's, by being traceable to it along a distinct and defined course, that the two proprietors can have natural relations with each other in respect of it, considered as the subject of separate existence. While the water forms a part of the soil and the produce of the soil, actually resting upon it, no proprietor can claim any interest in it, until it reaches his land, and neither can any proprietor claim any right to oppose another proprietor who attempts to prevent it from flowing upon his land.

So water, rising naturally from the peculiar property of the soil, and freely flowing over and beneath the surface, acquires no public character whatever, although it somewhere eventually may help form a stream; but before it becomes a natural stream, the owner of land may use it just as he sees fit; if the natural channel begins at the very source, like a stream from a well-defined spring or fountain, where the water first shows itself, then it at once assumes a public character, and cannot be interfered with to the injury of other conterminous proprietors. A river begins at its source where it comes to the surface; and a stoppage of it at the spring-head, is just as much a diversion of it, as if the water had been taken lower down.

I have entered quite at length into the examination of the subject of drainage, because it has seemed to enter quite largely into the many discussions before the Board, and it has seemed, generally, to meet with favor by agriculturists in this and other States.

How far the right can be exercised by one owner of land to the injury of another, seemed to me to be a practical question. In the suggestions I have made, I have generally adopted the language of the courts, believing it would be more concise than my own, and not liable to misconstruction.

IRRIGATION.

Another question suggests itself which is so intimately connected with the subject of drainage that it almost forms a part of it, to wit: To what extent has the proprietor of lands the right to use the water, flowing in a natural stream, to irrigate his lands? This involves a principle entirely different from the rights of flowage as conferred by the statutes.

The only right of flowage given by statute is what is known under the term "Mill Acts," and this right is restricted to flowage by means of a dam built upon the land of the proprietor, for the purpose of creating a water-power to run a mill; and such proprietor has no right to erect a dam upon land of another without the consent of the owner of said land. But the right of irrigation, if it exists at all, is a common-law right, and not as yet modified or controlled by any statute in this Commonwealth. And in the absence of any right by prescription, which presumes a grant, I think the language of Chief Justice Shaw, uttered several years since, clearly sets forth the rule, so far as a rule can be laid down, which governs the law of irrigation in this Commonwealth to-day. Said the learned justice: "It has sometimes been made a question whether a riparian proprietor can direct water from a running stream for purposes of irrigation. But this we think is an abstract question, which cannot be answered either in the affirmative or negative, as a rule applicable in all cases. That a portion of the water of a stream may be used for the purpose of irrigating lands, is, we think, well established as one of the rights of the proprietors of the soil along or through which it passes. Yet a proprietor cannot under color of right, or for the actual purpose of irrigating his own land, wholly abstract or divert the water-course, or take such an unreasonable quantity of water, or make such unreasonable use of it as to deprive other proprietors of the substantial benefits which they might derive from it, if not diverted or used unreasonably."

It will be observed that in courts generally, a distinction has been made in determining the question whether there has been an unlawful appropriation of the water of a natural

stream, between what may have been used for *natural* purposes, and what has been used for *artificial* purposes.

The supply for household purposes, to quench thirst, and water for cattle, has been classed among the natural wants, and these must be supplied or man and beast must perish.

But the supply of man's artificial wants is not essential to his existence,—it is not indispensable; he could live if water was not employed in irrigating lands, or in propelling his machinery, however much it might be to his convenience or profit. In some countries, where the climate is hot and arid, water, being necessary for the cultivation of the soil, might be a natural want for irrigation; but here, although it might increase the products, it is not indispensable for that purpose, and cannot be regarded as a natural want; and neither can manufactures, of however much importance, be regarded as absolutely necessary for man's existence.

The language of the Court as best defining the principles governing this subject is as follows, to wit: "That an individual owning a spring on his land, from which water flows in a current through his neighbor's land, would have the right to use the whole of it, if necessary, to satisfy his natural wants. He may consume all the water for his domestic purposes, including water for his stock. If he desires to use it for irrigation, and there is a lower proprietor to whom its use is essential to supply his natural wants, or for his stock, he must use the water so as to leave enough for such lower proprietor. Where the stream is small and does not supply water more than sufficient to answer the natural wants of the different proprietors living on it, none of the proprietors can use the water for irrigation or manufactures.

"So far as natural wants are concerned, there is no difficulty in furnishing a rule by which riparian proprietors may use flowing water to supply such natural wants. Each proprietor, in his turn, may, if necessary, consume all the water for these purposes. But where the water is not wanted to supply natural wants, and there is not sufficient for each proprietor living on the stream to irrigate his lands, how shall the water be divided? Without a contract or grant neither has a right to use all the water; all have a right to participate in its benefits. While all have a right to participate in a common

benefit, and none can have an exclusive enjoyment, *no rule* can be laid down as to how much each may use without infringing upon the rights of others." Each individual case depends upon the particular circumstances connected with it. The law will interpose to prevent any *essential* diminution of the water of a water-course which has a well-defined natural channel in which to run; the particular cases in which a right of action would lie for an infringement of this right, it may not be easy to point out. In any event, where the owner of land through which a natural stream passes, for any purpose whatever, sees fit to direct the water from its natural channel, he must take care that all the water not consumed by him, or absorbed in the soil on his land, is returned to its natural channel before it leaves the boundaries of his land.

SUPPORT OF SOIL.

Another important provision of law which has been much discussed, both in this country and in England, is the "right of support of soil from soil." By very many learned jurists it has been held to be a right which exists as an "easement," or in the nature of an easement, but as all rights acquired in the nature of easements are presumed grants, this right may more properly be called the result of a "rule of law," and not from *grant*.

When it is said "that the owner of the surface is, of common right, entitled to the support," the meaning is that he has the title without proof or presumption of grant.

Our own courts have said "that few principles of the law can be traced to an earlier or to a more constant recognition, through a long series of uniform and consistent decisions than that if the owner of land makes an excavation in it so near to the adjoining land of another proprietor that the soil of the latter breaks away and falls into the pit, he is responsible for all the damage thereby occasioned." And this, undoubtedly, is the law as recognized at the present time.

EASEMENTS.

The right which one proprietor of land may acquire over land of another proprietor, and which is commonly known as a "right of way," is worthy of attention, and may be acquired

in several modes. First, it may be acquired by express grant. Second, by presumed grant, or prescription. Third, by implied grant, or necessity. Fourth, by statute. All "rights of way" claimed under, or by virtue of an "express grant," are restricted to the terms of the grant, strictly.

And if the grant be for a particular purpose, or to a particular close, the person to whom the way is granted will have no right to use it for any other purpose, or to go to another close than the one specified. And it has been held that a grant of a way to "cross a lot of land" does not authorize the grantee to enter at one place, go partly across, and then come out at another place on the same side of the lot, and oral evidence will not be allowed to show the parties thus intended it; the words "to cross," used in the grant, having a well-settled and definite meaning, no evidence can be permitted to change it.

It was formerly held that if a grant of way is designated between certain termini, the grantee would have no right to deviate at all from the course designated, although the way become impassable, no matter from what cause; but it is now held that although a way may be specifically defined, and the termini marked out or fixed, yet if the owner of the land over which the way is granted in any way obstruct it, or render it impassable, a new way may be used over the adjoining land, doing no unnecessary damage.

Where a "right of way," generally, is granted, without determining its location, when the way is once elected it cannot be changed without the consent of all parties. Where the grant is of a reasonable way, what this means is to be determined by a jury.

But the owner of the soil has all the rights and benefits of ownership consistent with the easement. All which the person having the easement can lawfully claim is the use of the surface for passing and repassing, with a right to enter upon and prepare it for that use, by levelling, gravelling, ploughing and paving, according to the nature of the way granted.

And it has been held that if the grantor of a lot of land reserves "the right to pass and repass over the granted premises for the purpose of repairing his building," on an adjoining

lot, "at all times when necessary," the grantee is entitled to reasonable notice of the intention of the grantor to make repairs, before being liable to an action for obstructing the right of way. For it is not a right of way at all times.

A grant of "right of way" may be presumed from an uninterrupted adverse possession for more than twenty years unexplained.

Ordinarily, the same rules apply to govern the use of a way, claimed and acquired by prescription, as those acquired under a general grant by express terms in a deed.

If it appears that the way has been used by the *permission* of the owner of the soil, and not by *adverse* possession, then no length of time establishes the right to continue the easement, against the consent of the owner of the soil.

It has been said that the three modes of acquiring and holding "rights of way," to wit, by grant, by prescription, and by necessity, resolve themselves into one. They are all derived from the voluntary grant of the proprietor of the fee.

Prescription presupposes and is evidence of a previous grant.

Necessity is only a circumstance resorted to for the purpose of showing the intention of the parties and raising an implication of a grant. The only difference between the two is, that one is granted in express words, and the other only by implication.

And a way by necessity, created by an implied grant, exists only when the person claiming it has no mode of passing from his land to a public road without it. And whenever the situation of his land is changed, so that by means of a new road, or other cause, another way is provided by which he has access to a public street without trespassing upon the land of another, then the way of necessity ceases to exist, and he must adopt another way of approach to his land.

The right of way may be located by the owner of the land, when claimed as a way of necessity, but it must be a reasonable one; it will be remembered that convenience alone will not create a right for a way.

And when once located it is not a shifting way, but the parties are bound by it the same as though there was an express grant.

A right of way acquired by statute is that which is provided for similar to the laying out of public ways, and is conferred by municipal authorities, and will be confined strictly to the uses for which it was laid out.

All rights of way, acquired from whatever mode, must be used in accordance with the particular specifications of the grant, or the necessities requiring its use. Whether, after a way has been once located, it can afterwards be changed so that by parol agreement a new one can be substituted, which will confer an absolute right to use it the same as the former way was used, and not subject to revocation, has been somewhat discussed, and the principle upon which it would seem to be governed would forbid that any such right should exist, short of the continued, open, uninterrupted adverse use twenty years. But the right to use the former way would not be lost, until a right to the new way had been established.

The mere non-user of a right of way, created by grant, for a period less than twenty years, is not, of itself, sufficient to defeat the right to use the way. There must be some act by which it could reasonably be inferred there was an intention to abandon the way.

The natural question in all such cases is, whether there was an intention to abandon the easement before enjoyed, or whether the non-user is imputable to some other cause.

In whatever way the right herein referred to may be acquired, it becomes quite important that the claimant should understand the full extent of such right.

I doubt not my own experience has been similar to that of the majority of the members of my profession, in teaching me that a great part of the litigations in our courts, concerning real estate, grows out of claims of "rights of way," which, of themselves, are uncertain, either from the ambiguous language used by conveyances in deeds, where an express grant is made, or from the doubt which may arise as to what extent and for what purposes such right is claimed, and if claimed, whether it has been acquired.

Having considered to some extent the most important practical questions that suggest themselves relating to real estate, there are some other considerations relating to personal property which it may not be unprofitable to examine.

SALE OF PERSONAL PROPERTY.

What constitutes a sale so as to vest the title of the property in the vendee, is sometimes a question not altogether free from doubt.

As between the vendee and third persons, the general rule that there must be a delivery to, and acceptance by the vendee, is a safe one to follow.

As between the vendor and vendee, no delivery is necessary to vest the title in the vendee. In cases where a delivery *is* necessary, what amounts to a delivery? Will anything short of an actual manual possession of the article be sufficient? In cases where the nature of the property is such, and the same is so situated that a personal possession of it is impracticable or inconvenient, then the mere pointing out or showing the same to the vendee, the vendor being required to do no further act in respect to it, has been held to be a good delivery.

Where a certain number of articles are sold under an entire contract, and for one gross sum, a delivery of a part has been held to amount to a delivery of the whole, although scattered in different places.

But where a certain quantity of articles are sold to be taken from a larger quantity, by being measured or weighed, a delivery of a part of the amount sold does not operate as a delivery of the whole, so as to vest the title in the vendee as against third persons, unless the whole amount sold has been separated from the larger quantity.

A delivery of a key to a storehouse in which the property sold is stored, with the intent to surrender the possession of the property, will amount to a delivery.

And where the owner of a horse, kept at a livery stable, agreed at another place to sell it, received the price from the purchaser, and at the same time the seller paid the stabler for the previous keeping of the horse and the purchaser directed him to continue to keep it and feed it on hay, and promised to pay him therefor, and the stabler afterwards removed the horse from the stall in which it had been, to another more convenient for feeding with hay. Held, in the absence of fraud, these facts showed a delivery of the horse against a subsequent attaching creditor of the seller.

Where a quantity of grass standing upon a lot of land was sold early in the season, and before it was fit to cut, and a handful of growing grass was plucked and delivered to the purchaser in the field, in part execution of the contract of sale of the whole crop, it was held not to be a good symbolical delivery of the grass. The grass, until severed from the land, was not personalty but a part of the realty, and therefore could not be delivered as personal property.

The same rule undoubtedly applies to a contract for wood and timber standing upon land of a vendor. There can be no delivery sufficient to pass the title to the vendee, as against one to whom the land had been conveyed by deed without reserve, or against an attaching creditor, unless the wood and timber had been severed from the land.

Of course this rule applies only when the wood and timber is sold as personalty. It may be sold and conveyed by a deed the same as the soil, and confer a good title in the vendee. Where a sale is made on condition that the property shall remain the vendor's until paid for, no title vests in the vendee until the condition is complied with. And this will be so, although the property is delivered to the vendee at the time of sale.

And whatever may be the condition, if not contrary to some statute provision, no title passes unless the condition is strictly complied with, unless there are some acts of the vendor subsequent to the sale that amount to a waiver of the condition.

And where a sale of personal property is sold for cash, and the vendee gets possession of the property without paying therefor, no title passes, and the property may be reclaimed by the seller.

Whenever property sold on a condition which has not been fulfilled, is sold by the vendee to one ignorant of the conditions of the original sale, the vendor in the first sale may recover his property or its value of the one who has the possession of it, unless he himself is guilty of some laches in claiming it.

When a party sells personal property, he is understood to affirm that the property he is selling is his own; a warranty of title is implied.

The vendor of personal property frequently is held upon a

warranty of the articles sold, although not a word about warranty is said at the time of sale.

A vendor of provisions is held to be responsible upon his warranty that the articles of food sold by him are sound and wholesome; the very offer of sale implies this.

So where the vendee wishes an article or an animal for a particular purpose, and that purpose is specifically named to the vendor, and the vendor undertakes to offer, and does offer for sale an article or animal to supply the specific want, there is an implied warranty that it is suitable for the purpose for which it is sold, and the vendor will be liable, as much so, upon his warranty, as though in express terms he had warranted it to the purchaser.

And although the purchaser does not specifically enumerate the purpose for which he desires the property, if the vendor uses any expressions equivalent to a warranty, like "he is all right," or "he is sound," or similar ones, he will be held to have warranted the property just as strongly as though he had said "I will warrant it all right," or "I will warrant it sound."

Where there are no acts or words of the vendor which amount to a warranty, express or implied, and no fraud, then the maxim, "*caveat emptor*," "let the purchaser take care," applies.

A bill of sale of "one horse sound and kind," is a warranty of soundness. And it makes no difference whether a horse is sold for cash, or exchanged for another horse, any words used or acts performed which amount to a warranty in a *sale* of a horse, are none the less a warranty when used in an *exchange* of *horses*.

The sentiment which has become so universal, that one may almost regard it as a *custom*, "that one may *cheat* all that he chooses in the exchange of horses," has not yet become a *law*, and a contract "to swap" horses is regarded as valid and binding upon the parties as any other, and the parties are held in law as strictly accountable for every word used, and every act performed, as though the contract had reference to any other animal or article of merchandise, or any bargain or agreement between the parties.

I am now admonished that the hour allotted me has nearly passed. You will remember that the presentation of the

questions to which your attention has been invited must be limited to the abstract principles to which they refer. The examination of legal questions is not always attended with the greatest interest, even to members of my own profession, and if I have been able to present a few principles of law which may now or hereafter assist any of you, either in securing your own rights or in preventing you from appropriating to yourself, under a color of right, that which rightfully and lawfully belongs to your neighbor, I shall have received great satisfaction and full compensation for this service.

Mr. Flint. Before passing to the next topic, I wish to remark that I heard a gentleman say, before I came into the hall, "I hope the speaker will touch upon the rights a purchaser has to the manure on a farm." That is, how far the manure on the farm or in the yard attaches to the realty. I think a few words from him in reference to that subject would be very interesting.

Mr. Fay. The members of the Board will understand that there were a great many questions which might be presented and discussed, which were not presented in the examination which I have made of this subject, for the very reason that time would not permit; for if I undertook to present all the questions which arise in relation to farm-lands and in relation to landlord and tenant, it would require a whole course of lectures. But the question suggested by our worthy Secretary is a question which can be answered in a moment. I suppose that, generally, the rule applicable to that case is this: That where a sale is made of real estate, upon which there are piles of manure standing, either upon the land or about the buildings, and a conveyance is made by deed, without reservation, that manure passes as part of the realty. There is no chance for a question about it then; but sometimes a question arises where there is a sale of real estate, where the estate itself is not used for farming purposes, how far the manure which is then standing heaped upon it, or in any form, will pass, unless a reservation is made. It is difficult to lay down a rule which will apply in all cases; but it will be safe generally to adopt this rule: that where there is manure upon a farm, and the farm is sold and conveyed with-

out reservation, the manure passes with the realty; but in case, for instance, of the sale of a hotel where there is manure standing, the manure is counted as personal property, and will not pass with the realty.

Mr. Wetherell. I would like to ask, if a farmer sell a farm contiguous to his own during the winter, possession to be given on the first of April, and before possession be given removes the manure made down to the time of transfer,—as was done in a certain case,—has the purchaser any recompense?

Mr. Fay. There is no doubt at all upon that question; the party who got possession of the manure would hold it. The only question is, whether or not there was any fraud used by the party conveying the property. If the party purchasing supposed the manure was included in the property which he bought, and somebody else got the benefit of it, that might raise a question; but it would be a difficult one, perhaps, to settle. There is no question that the manure did not pass, because it was not upon the land when sold.

The question is asked, What are the rights of abutters on the highway against the intrusion of the highway surveyors when digging gravel by the side of the road, or against barways or gate-posts? That is a pretty broad question to present; but I have no doubt it has been propounded in good faith, and I will endeavor to answer it as briefly as I can. If gentlemen will take the pains to refer to the General Statutes of this Commonwealth, they will find that there is a specific provision pointing out the rights of parties in case their land is injured in any way whatever in consequence of the raising or lowering of a highway. Their remedy is to recover damages. There is no question about the right of surveyors to come in and cut down, or fill up the highways, and if parties are injured in consequence of it, the statute points out specifically what are their rights in relation to the recovery of damages; but the right of surveyors is unlimited if they act in good faith.

THE CATARRHAL EPIDEMIC.

BY PROFESSOR D. D. SLADE, M. D., BUSSEY INSTITUTION.

Mr. Chairman and Gentlemen:—I present a few practical observations upon the epidemic which has prevailed so extensively among horses throughout the northern and other portions of this continent, and which is known under a variety of names,—such as influenza, distemper, epidemic catarrhal fever, catarrhal epidemic, typhoid laryngitis, &c.

What is to be understood by the term epidemic, or more properly, in this connection, epizootic?—the former word signifying "among the people," the latter "among the animals." Epidemic diseases are those which attack at or about the same time a number of individuals collected within a certain district. The laws which govern them, and the causes to which they owe their origin, are far from being understood. Scientific research, however, has established this fact: that their prevalence is often due to climatic influences,—such as the alternations of heat and cold, great and long-continued moisture, exeessive droughts, as well as also to the deficiency or bad quality of common articles of food. Wherein lies the essential power of these "climatic influences," whether it consists of certain minute particles, inappreciable by the ordinary modes of investigation, originated and set in motion by those influences, or whether by other means, has not yet been determined. Here opens a field for scientific discovery which has scarcely been entered on.

Epidemics, whatever may be their nature, are intimately associated in most minds with contagion; that is, they are thought to possess contagious properties upon which their prevalence depends. By contagious properties we understand the spread of a disease from one individual to another by means of a poison conveyed in a distinct form, as by the secretions of the mouth or nose, or in an imperceptible form, as by the exhalations from the lungs or skin. Now, while it is true that epidemics of well-known contagious diseases, as of small-pox, for example, not unfrequently prevail, it is by no means necessary, nor is it true, that any or every epidemic, of whatever nature, should be contagious. Their origin, their sudden

and simultaneous appearance over a wide extent of territory, would show that they are often due to other influences than contagion, in the sense at least just given. Still, under circumstances not yet recognized, certain diseases may prevail in an epidemic form, and prove contagious at one time, which at another time do not possess this character, or do not make it manifest in the usual manner. If we may trust the observations which have been made, epidemics of this very disease under consideration have spread from time to time over large portions of Europe, at one season being highly contagious, while at another they have not been thus characterized. It is only by patient and close investigation that we can hope fully to solve the problems connected with this question of contagion.

There are other peculiarities of epidemics which deserve notice. Thus, while all epidemics of the same disease may present well-established features, these may vary greatly in different years. Sometimes the symptoms which they exhibit are very mild, and terminate quickly in complete recovery, while at other times they are exceedingly severe, assume a chronic form, or tend to a rapid fatality. In most of the catarrhal epidemics of Europe it has been observed that the young are the most susceptible, and the aged the least so; that the spring months and very wet autumns are the most conducive to the disease; that where large numbers of horses are collected in crowded cities and towns, and where proper attention cannot be paid to hygienic laws, there the malady exerts its full force. Then, again, in some epidemics the disease confines itself almost entirely to the nasal passages, while in others it attacks the air-passages generally, expending its power upon the lungs and other important organs, whereby we may account for the various names and treatment to which it has been subjected. Formerly catarrhal epidemics were eminently febrile, that is, of an inflammatory character, and in many cases admitted of bleeding; but more recently they have shown typhoid symptoms, that is, they have been marked by great debility, in which the letting of blood has been contra-indicated.

We have been singularly exempted in this country from the prevalence of epizootics, but we cannot hope always thus to

escape; therefore it behooves us to study well the nature of these diseases, wherever they may present themselves.

The present catarrhal epidemic offers nothing new to those familiar with the descriptions given by veterinary authorities from the earliest periods. A similar affection prevailed in New England in 1841, although not so extensively. In a letter to me by that indefatigable and close observer, Dr. H. I. Bowditch, of Boston, he says, speaking of that epidemic: "We studied it thoroughly, visiting all the stables in the city and learning about the status of at least twelve hundred horses in the various establishments. These numerous stables we could classify into three distinct grades, according to their hygienic qualities, and we found very curious results, showing at least in that epidemic the vast value of care in this respect.

"The first class consists of stables that were well aired, lighted and dry, and had comfortable quarters generally. The third class were wanting in all these qualities, while in the second class we found all the stables wanting in either one or two of these qualities. We found the following very curious results: In the first or good class, scarcely any horses were affected, or very slightly. In the second, or those wanting in some respects in regard to hygiene, the horses were more generally affected. But the third, or the utterly vile stables, had almost every horse seized, and in some deaths occurred."

The recent epidemic had its apparent origin in or near Toronto, in Canada, about the 9th of October. Thence it spread in three directions. To the north-east to Montreal, where its reported appearance was on the 11th of the same month. To the south-west in the direction of Detroit, in which city it appeared on the 15th Oct. To the south-east by way of Buffalo and other cities in western New York, where it arrived on the 18th. It made its appearance in Boston on or about the 22d Oct., and in the western part of the State a few days later, whether by way of New York, or by the first of the routes mentioned, east from Montreal, it is difficult to determine. Its general character, in New England at least, has been mild, and not attended by marked fatality, although recently it appears to have taken on complications of a chronic

form. The following symptoms have been most frequently observed: Slight shivering, which, however, may pass unobserved, followed by increased heat, a more hurried respiration and quicker pulse. The lining membrane of the nostrils assumes a brighter red, becomes congested and generally more dry than natural, a condition, however, which is followed at irregular intervals of from twenty-four to forty-eight hours by a thin watery discharge, that soon takes on a thicker yellow flaky purulent character. The inflammation, following the course of the lining membrane proceeding upward, attacks the frontal sinuses and neighboring parts, as evinced by the drooping head, the swollen eyelids, the sleepy expression; or proceeding downward, the upper portions of the throat are involved, producing soreness of these parts, recognized at once by the more or less inability to swallow, and accompanied by a swelling of the neighboring glands about the jaws. Continuing onwards in some cases, the larynx or upper portion of the wind-pipe is attacked, by which a hard dry cough is produced, the inflammation being arrested here; while in others, it attacks the deeper seated portions of the air-passages, and even the tissues of the lungs, producing pneumonia. As the period of debility sets in, which is during the early stages of the disease, generally upon the third or fourth day, the pulse is slower and the appetite is more or less affected, according to the severity of the attack. This peculiar debility is a very decided feature of the disease, and has been present to a greater or less extent in every case. The healthy action of the bowels and kidneys is more or less interrupted, and there is an unnatural coldness about the lower extremities. If the disease tends towards recovery, there is a slow improvement in all the symptoms. The appetite gradually comes back, the countenance becomes brighter, the temperature of the body more equable, and the cough and soreness of throat much less, although the discharge from the nostrils may not diminish but even increase. On the contrary, if through the severity of the attack, or through ill-treatment and bad management, the disease progresses, the symptoms just mentioned grow worse, the respiration is increased, there is great coldness of the extremities, excessive prostration, feeble pulse and death by extension of the inflammation to the lungs; or where the

lungs have not been attacked, the disease becomes chronic, the animal is very weak, and there are extensive effusions into the lower extremities, and in some cases swellings appear on the chest, belly and even head. Such are the symptoms as they have generally presented themselves in the present epidemic. Of course they vary very much according to the circumstances in which they are found.

As regards the prognosis, or the foretelling what will be the termination of an attack, not much can be said. If the symptoms are mild, and the animal placed under the best hygienic conditions, our prognosis may be a favorable one. Even here, however, we must be guarded, for there have been cases where a speedy recovery was to be expected, but where new and unlooked for symptoms have arisen, terminating in death. If the general symptoms from the first are severe, especially if the prostration is great, we may consider the danger imminent.

The treatment of the disease depends very much on its violence. In the great majority of cases where the symptoms have been mild, as in the present epidemic, very little is required. Comfortable, well-ventilated quarters, plenty of room, warm clothing, great attention paid to cleanliness,—gently laxative food in the form of bran mashes or roots, with water either cold or tepid, walking exercise if the weather permits, and general good nursing, constitute all that is requisite. Where the cough is severe, and the debility with loss of appetite greater, the strength may be supported by oatmeal gruel, made thin, in the place of water. This should be changed frequently, even if not touched by the animal. Fomentations or mild blisters should counteract any undue soreness of throat, and the nostrils be kept as free as possible by sponging them frequently. If the distress about the head is great, which will be recognized by the symptoms already described, steaming, by means of a bran mash suspended in a bag to the head, should be practised. This should be kept up for an hour at least, the hot water being poured on to the bran every fifteen or twenty minutes. This process of steaming should be kept up as long as the symptoms warrant it. The bowels, if confined, should be kept open by simple injections of warm water,—five or six quarts,—to which a handful or two of

common salt may be added. Purging by drugs must be carefully avoided. Bandaging and hand-rubbing of the legs will restore warmth and counteract the swelling of these parts. It must be remembered that the whole plan of treatment should be directed toward maintaining the strength; particularly is this the case where the prostration is very marked from the outset. During the period of convalescence, which in many cases has been long, very great care must be taken about exposure to wet and cold, and if the appetite does not return, some mild stomachic may be given, as the extract of gentian with ginger, and use may be made of cider or ale in moderate quantities. Generally, nature affects the cure without our assistance. Should symptoms of pneumonia or lung fever be established, which will be recognized by certain signs,—such as rapid breathing, standing with legs wide apart, extremities excessively cold, short and painful cough, quick, small pulse,—we have to deal with a most formidable malady, and one which will, in spite of all treatment, tend to a fatal termination. Here the services of a competent veterinary practitioner should be secured, if possible; if not, make use of the means at hand, and already indicated; clothe warmly and give the animal abundance of fresh air, guarding against draughts. As a means of counter-irritation, extensive mustard poultices should be applied to the sides of the chest. Where extensive swelling of the lower extremities, abdomen, chest and head follow, as complications such as I have recently seen, no treatment can be of essential service. These conditions are dependent upon extreme prostration of the system, and not to be considered as a new disease.

Much has been said of the use of disinfectants in this epidemic. These should be employed under certain circumstances, but are not to be too much relied upon as a means of warding off or preventing the disease. Neither is any other substance or plan of treatment to be so considered, as certain individuals in every epidemic will escape, no matter to what exposure they may have been subjected.

To sum up our remarks. The disease in question is a catarrhal epidemic, described by veterinarian authors as having prevailed at various times from the earliest periods, analagous in many respects to the same disease which attacks the

human family, and dependent probably upon unknown atmospherical influences. The present epidemic originated in Canada, under what peculiar circumstances we are unable to state. It would seem to be a self-limited disease, running its course in a period varying from ten to fourteen days, not contagious, and not amenable to any particular plan of treatment, either preventive or curative, beyond what would be dictated by the simplest knowledge of the laws of health and disease. Prone, however, without special known cause to extend beyond the above limits, and to take on grave complications. Not necessarily a follower or forerunner of other diseases, although such has often been the case in previous recorded epidemics.

Dr. Joseph Bates, of Worcester. I do not think I can add anything to the testimony of the very able paper of Dr. Slade. I have been examining the horse disease for the past five weeks with a good deal of scrutiny. I have probably examined from five hundred to a thousand cases of diseased horses, more for my own gratification, perhaps, than anything else, although I have had sick animals. For forty years, up to last Thanksgiving day, I do not think there was ever a time when I did not have a pair of horses to drive, but on that occasion I was forced to come here by public conveyance. So far as my observation has extended, the form of the disease in Worcester, particularly, and here also, has been more an inflamed condition of the lungs and throat. The usual treatment which I have observed, as practised by one and another, has been abominable. In many instances too much has been done. Many poor animals have been treated as though they were very sick, and many no doubt have died from the treatment rather than the disease. For instance, some of our stage horses which were used from the time their sickness commenced until the day they died, had for treatment a swab dipped in tar run down their throats three or four times a day,—a treatment which I should rather infer the human family would not submit to under such circumstances; but so far as my observation has extended with regard to the character of the disease, it has been a form of disease of the lungs; a form of pneumonia. At one time, I

recollect distinctly, it became the prevalent opinion in Worcester that all the horses should be led out and exercised, whether they were able to come or not. The result was that gentlemen lost a great many of their horses from exercise. Why? Because the inflammatory condition of the lungs forbade exercise. The poor animals could not lie down; they could not lie down when subjected to that form of the disease. Indeed, pneumonia, in many cases forbids the lying down of the animal affected. I believe that in many cases, if the owner had been left to his own intelligent judgment, rather than been guided by the judgment of his groom, many horses would be living that are now dead. In many instances, within the past two weeks, horses that would probably have recovered, have been put into carriages and driven five or six miles under the mistaken idea that it was necessary they should be exercised, and have died before they got home. I have three horses now sick; one of them is suffering from paralysis of the extremities, particularly of the forelegs. I have heard the remark made by several gentlemen, that they considered that they prevented their horses from taking the disease, one by feeding with apples, another by feeding with apple pumice, another by feeding potatoes, and another has kept his horse within bounds in his stable, and has not exposed him. I have heard of two horses owned by one gentleman,—and I hope we shall hear from him,—who has exposed those horses in a very particular manner, but they have not as yet been attacked by the disease. That is no reason why they should not have it, and they probably will have it if they are exposed. Many are in the habit of covering their horses from the period when they are attacked through the whole course of the disease. Some did not blanket at all, and their horses are in a better condition than horses which were covered. Many a poor horse which has been blanketed during the disease, will be deprived of that blanket when the disease has passed away, and will die before spring.

So far as regards the use of apples, or any other of the acid fruits, I consider them to be very appropriate food for the horse, or the ox, or any of the animal kind which are subject to epizootic disease, or any epidemic diseases of the character which we are now contemplating, inasmuch as they relieve

the secretions of the animal, and perhaps absolutely prevent the disease. I do not know that they do, but I think very likely that they do. I merely give you these opinions, gentlemen, for what they are worth.

Mr. Hubbard. The gentleman last up says that if horses are exposed, he thinks they will have the disease. Now, the first gentleman said that he thought the disease was not contagious.

Dr. Bates. I do not say that it is contagious; I say the horses are exposed to currents of atmosphere, not exposed to the disease in other horses.

Dr. Slade. I have three horses, and neither of them has yet been attacked by the disease, although surrounded by it on all sides. By some mysterious power, which I do not understand, my horses have been protected; neither of them has shown the slightest symptoms as yet, but that does not prove that we shall not have it in our stable. I do not believe, of course, in the preventives which I see constantly recommended. One man recommends a large piece of assafœtida tied to his horse's bit, and there is a great deal such nonsense, which, of course, cannot have any effect.

Mr. Sessions. It may be that doctors' horses are more exempt from this disease than those of farmers. There is a physician in our place whose horse has escaped thus far, and of course he has exposed him, if there is any exposure, for he has driven him night and day, on all occasions and in all places. I asked him why it was that his horse had escaped the disease, and he said he did not know, unless it was that he took care of him. I have three horses that I fed with apples from the first of October until the day of election. On that day, they all three showed symptoms of the disease, but in a mild form, and we are now working them every day. I flattered myself, up to that time, that the apples prevented the disease from coming into my stable, but they did not; nevertheless, I think they are a great help.

Dr. Wakefield, of Monson. May I render a short account of my stewardship in regard to horses? We have had six working-horses and two colts. They have all been sick, but not very sick, I suppose. I have seen but few cases except our own. I have treated them in this way: I have

taken the heavy feed that the working-horses formerly had, from them, and put them on to a light diet,—mashes of oats and carrots,—and given them no medicine with the exception of a little Jamaica ginger and elecampane; I made the mixture and gave it to them when the disease was at its worst, and I think it gave them some relief. I did not blanket them while they were in the stable, because I believed, with my friend Dr. Bates, that they were better off without it. It was not very warm, but on pleasant days, when the sun shone in the middle of the day, I turned them out for two, three or four hours, into a lot, so that when it was dry they would get the sun and pure air, and although they were chary about eating, they would nibble the grass a little. They have all of them recovered now, so that I can work them. We did nothing with those six horses except tend the post-office and depot, and such things as we must do with a horse. The treatment was to keep them in the stable, give them the best air we could there, blanket them whenever we took them out of the stable for any purpose, rub them well in the legs, especially if they were cold, and they were most all troubled in that way; and I believe that they were better off than they would have been if they had taken large quantities of medicine, and been bled and blistered in the state of the disease which was manifested there. Very likely there have been cases which required more active treatment, but I am sure ours did not, and they are coming out of it with that simple treatment better than I expected they would.

Mr.———. I have a horse that has not had the disease, and I will give the treatment. After the commencement of the disease, the horse had a quantity of apples every day until some time about the 20th of October. After that time she had two quarts of potatoes in the morning, and when she had the apples, and when she had the potatoes, she had a small quantity of salt and a small quantity of ashes put in the manger, and her food at night was fine feed. On warm days she was out without a blanket, and when the day was cold, she was in the field with a blanket. I have driven her round to the different villages, hitched her to a post, and covered her up with a blanket, and when I got home I have covered her up with a blanket, rubbed her freely, given her a good warm nest

in a well-ventilated stable, and she has not had the disease, while my neighbors' horses have had it.

Mr. Allis, of Conway. The fact that there is no certain exemption from this disease can be certified to. You may know, perhaps, that a horse that had been at work in the Hoosac Tunnel for months, a thousand feet below the surface, has had the disease. I saw a horse last Monday, in Greenfield, that after he had begun to improve, as it was thought, was taken with very severe swelling on his forelegs, and they actually swelled so that the skin burst. I saw it myself, and the owner said that it had been so for three or four days. In fact, it was announced in the Springfield papers that the gentleman had lost that horse; but the horse was then alive, and he said, "I am giving that horse two quarts of gin a day, and have been for four days, and he is actually improving."

Mr. Root. This is an "experience meeting," I suppose. I have not had any experience with gin, but I used to give good old-fashioned cider. One of my horses was taken with coughing in the morning, and I gave it the usual remedy for a cough which I keep in my stable. During the forenoon I considered what I should do. Conceiving it to be an unfortunate condition of the mucus membrane, I thought that anything I could give it that would act upon the blood as a stimulant and a diuretic would be useful, and I came to the conclusion I would give it some cider that was about three weeks old; and accordingly I poured a quart of cider into the meal for the horse, and put it into his manger, and he went for it with a relish. I gave him a quart of cider three times a day, with his meal, and he ate it with great avidity. The other horse was taken, and I gave her the same treatment. She took it with equal relish. One day I told my little boy to give the horses their usual cider, and when I came home he said, "Father, Major will drink cider like—" I won't say what. I said, "How do you know?" "Why," said he, "I put it up to his mouth to see if he would drink it, and he took it all down!" The result was that those horses did not fail a single day to take their meal. Their appetite kept good, and in two weeks from that time they had apparently lost any unfortunate effect from the disease, and were put to work moderately during the time. They were used a little, and but a little, in pleasant weather. One of the horses

actually gained in the two weeks, and the other, to all appearances, did not lose a pound. This is my experience.

Mr. Babbitt. As it is necessary to have a great many of these facts, I wish to relate my experience. My horse came down with the disease, and as I had great faith in homœopathic medicine, I administered four pills. I did not have much faith that those four pills would counteract the disease. I noticed that the horse would not eat at first. I examined him and found that his throat and tongue were sore and cankery. I warmed some vinegar and took a sponge and rubbed his mouth and throat down as far as I could reach. Then I took a bag, into which I put a kettle of vinegar, and dropped a hot brick into it, and held it over his nose ten minutes. When I took it away his nose discharged profusely. I was astonished, and I followed that for four days. After I got through with the steaming, I took a sponge and cleaned out the nostrils. Following that course for four days, night and morning, the disease was cured entirely. One of my neighbors said that the horse was lame before, but after that his lameness was cured.

Mr. Goodman, of Lenox. Did he have the same remedy—gin? It is not safe to differ from doctors, especially when you expect to employ them. I believe both the physicians who have spoken of this disease agree that it is not contagious. I suppose they mean by that that one horse does not take it from another; but it may be infectious. Now, from the experience of a great many who have owned horses, as well as from the observations I have made, I am of opinion, without being a physician, that it is in some respects a contagious disease. Take the towns throughout the rural districts. We have found that all the horses that went to the villages for purposes of business were attacked; all the stage-horses that went to a town where the disease existed, came back diseased, while those horses which were kept in the stable, and did not come in contact at all with other horses, have been exempt. It seems to me that the disease must be at some time contagious, because we find that in stables where there are a hundred horses, if one is attacked they will all have it; but in the country districts it is only the horse that comes in contact with other horses that are affected by it that is at-

tacked. Then it affects men. I have known cases of men who have lost their sight by the fluid from the nostrils of a diseased animal striking the eye. There must be contagion there to produce such a result.

Now I do not suppose that any one particular remedy is a specific. There are a great many people with strong constitutions who can take the various nostrums that are advertised without being injured by them, and there are a great many others who cannot use those medicines at all. We have found one thing in our experience during this disease that may perhaps be of value in our treatment of the human system: and that is, the less medicine we take the better we are off. The Dr. Sangrado system of blood-letting did not answer with horses. There were some three hundred killed in western New York by bleeding them. When people found out that the horses needed good nursing and very little medicine, and were wise enough to get acquainted with some good veterinary surgeon, or other physician who could be applied to in cases of necessity, those people preserved their horses. We have learned a good lesson from this disease in regard to our method of treating our animals. We have heard a great deal said about the best way to feed and take care of our cows, and Mr. Bergh, of New York, and other gentlemen in Massachusetts, have been teaching some of us how to use and manage our horses. I hope the result of the lessons of this disease will be that, hereafter, those of us who are farmers, as well as those who own horses for other purposes, will treat them in a more humanitarian way than heretofore.

There is another subject which I think worthy of notice. The horses that have died have been those which have had the greatest care taken of them. They have been, in many instances, very valuable horses, which have been kept in the most pampered state; such horses, for instance, as the "Green Mountain Boy," and several others. Horses that have had a great deal more care bestowed upon them than the owners bestowed upon themselves, have died; while those that have had very little care have not died, and very many have escaped the disease entirely. But it will not do to argue from that that we ought not to take good care of them, any more than to say that gin and cider will cure them.

Mr. JENKINS, of Barre. I have very little to say upon this matter. I have three horses that have received the same treatment since the prevalence of this disease that they have always received, except, perhaps, that they have been fed rather lighter and exercised less violently, probably, although no special pains has been taken in that direction. Neither of them has been sick. My nearest neighbor, the doctor, finally caved in, his horse being sick. Mine have not been sick at all. I have not changed their diet. I have not changed anything except, perhaps, I have fed them a little less grain. But I have not vaccinated for the disease, nor done anything to prevent its attacking my horses. They are, as I have said, in perfect health. They have been worked daily, not particularly hard, nor in very long drives. We always take care of our horses; blanket them when we let them stand outside, and make them comfortable in the stable. The stable is well ventilated, their food has not been changed, and, as I say, they have not been sick. I do not know how soon they will be, but I hope not at all.

Dr. BROWN. Nursing is all that my horses have wanted. I had seventeen of them, and they have all been sick, moderately. I think the matter has been sufficiently ventilated here, that nursing is what our horses want. I am very much interested in some of the questions that came up this morning about stock-breeding, which were left in an unfinished state. I want to learn something in regard to those subjects.

Professor AGASSIZ. During the discussion this morning concerning hereditary influence, there were some assertions made which lead me to suggest a practical measure which will help in fixing our opinions or knowledge concerning this question. Generally, scientific men are supposed not to be praccal; but I think that in my intercourse with farmers, which has covered a great many years, I have learned somewhat how science may be applied to practical purposes; and in this instance I feel that the suggestion I am going to make came to my mind by the discussion, and by the evidence that we are not sufficiently informed upon many points.

I heard, for instance, the statement made to-day that the essential difference made between some animals consisted in their having a fine or a coarse fibre, or that it consisted in the

harmony of their structure. Now I believe that these are words without a definite meaning. I do not believe that it is possible with any microscope at the present time to discriminate between the fibre of one breed and the fibre of another breed. We have not the means of such minute investigation, and yet it is assumed as a matter of course that a fine and delicate, or coarse fibre, constitutes the essential difference between some animals as compared with others. I have no doubt that there is something by which farmers are able to appreciate the difference, but when they speak of it as being in the fineness or coarseness of their fibre, all who are accustomed to examine the tissue of animals under the microscope know that there is nothing with which we are conversant that corresponds with such expressions. Now, I should like to know what is meant by that, and I think it would be very useful to us if those who use such expressions would tell us what it is, practically, that suggests to their minds the differences between different animals.

And so it is with the words "harmony of structure," "well-proportioned relations of the members of the whole frame," and so on. I do not think that we have, anatomically, the means for determining them. I do not think that there exists, in all the agricultural colleges of the United States put together, in all the medical schools put together, a sufficient number of skeletons of any one breed of domesticated animals by which it could be determined what is the normal proportion of any one joint as compared with any other. Now, that is an important investigation, and the investigation would not be difficult if we would go to work in the right way. The first step would be to get a large collection of skeletons, and after we have studied the skeletons, we shall be able to examine the muscles that move the head; and after we have examined those, we shall go one step further, and examine the nerves and blood vessels; but that will take generations. We cannot expect to have the information next year; it will take generations; but we shall have the result the sooner, the sooner we go to work and make the collection upon which such investigations can be based. Now, I would reiterate my request to farmers, to supply the museum at Cambridge with carcases of such animals as are known to them, the pedigree

of which is well authenticated, that gradually a collection may be made which will furnish the means of discovering what are the relations of the joints, the length of the bones, the solidity of the bones, and their dimensions, which characterize one breed from another. For instance, everybody knows a dray-horse from a through-bred by sight, but I do not know that there is any anatomical statement giving the dimensions by which the differences can be appreciated numerically, as they should be, and when we inquire into the hereditary capacity of one breed as compared with another, as we consider the increase of capacity to transmit the qualities from one to another, we have no standard; it is only a general impression; it is the recollection of what we have seen in one case with the recollection of what we have seen in another case. We should have something more tangible than that. If we had a solitary skeleton of the first imported animals of the breeds which we raise in this Commonwealth, which we could compare with their progeny, we should have something of real use. I think nothing would be more useful in coming generations than to have a collection of a succession of generations of any one breed, or, if it is possible, of all. Suppose any gentleman who raises Ayrshires with success now, would begin to preserve the carcases of every one of the animals which dies on his farm, and generation after generation preserve these carcases, by making them into good skeletons, in fifty years there would be a collection of a hundred carcases, which could be compared with one another. And do not think that two or three hundred skeletons of one and the same breed will be any too many, in order to make the kind of investigation which will give us a standard. An average is not obtained by observing a few dozen individuals; we must count the cases by hundreds, if possible, by thousands, before we can have anything that can be considered reliable.

Now, the museum in Cambridge is organized upon such a footing, that we are beginning to make collections for the school, in order to prepare materials for future investigation. As I cannot buy horses by the hundred and slaughter them to make skeletons, I make my preparatory investigations upon specimens which are not costly. The only species of vertebrate animals of which I have more than one hundred

skeletons is the cod-fish. I could not afford to have even rabbits; but I could afford to have cod-fish, which the fishermen give me when they smell too high. The plan I have laid out is so expensive that I have to resort to those means in order to make a beginning in any way; and as your domesticated animals will die, and when they are dead they are a nuisance to you, of which you want to get rid, I beg you to send them to me; I will take good care of them, and I will put them up with your names upon them, if you will send me trustworthy pedigrees with them; and I will go on until thousands are collected, which will furnish data for real knowledge, and not guess-work.

MR. WARD, of Bridgewater. In regard to the horse disease, I have one fact which I thought I would state, because it has been stated that old horses were less liable to the disease than young horses. I have a horse, perhaps fifteen or sixteen years old, with a colt a year and a half old, in the next stall by his side. The old horse has been attacked, and the colt, so far, has been free from the disease. My horse was attacked about ten days ago, having been exposed to the disease for a long time, being driven every day; but for the last ten days, probably, before he was attacked, he was entirely free from any contact with any other horses.

It has been stated that sick horses have been fed with apples, potatoes, gin and cider. One of my friends had two horses taken sick, and he intended to steam them with vinegar. He lived about eight miles from Boston, and when he went into the city in the morning, he told his man to have the vinegar and two hot bricks ready when he came out, at a certain time, and he would then be ready to oversee the steaming. It so happened that he was unable to take the train he intended, and did not arrive at home until half an hour after the time set. He then went to the barn to attend to the steaming, and found that his man had got everything ready, but the vinegar was not so hot as to prevent the horse, when it was put to his nose, from drinking it up. I suppose that horses in a state of health would not drink an acid article of that kind, and in the state in which they were, it seemed very strange that they should drink vinegar; and I mention the fact, thinking

that some gentlemen here, who are familiar with the subject, may possibly throw more light upon it.

Dr. JOSEPH BATES, of Worcester. There are a great many good things which have not yet been said in relation to the horse disease. A friend at my left suggests that he has been driving two horses for some time, one diseased, the other not diseased. That is a pretty conclusive fact for my friend (Dr. Sturtevant) who inquires, "Is the disease contagious?" I contend that it is not. I contend that the causes are perhaps in the atmosphere, rather than elsewhere. The horses that he speaks of as going from home to the post-office and the various places of amusement or places of business, are the horses that are exposed to the atmosphere. Had they remained at home in their stables, well protected, they would not have had the disease, as I understand it.

Then again, it is often said by gentlemen who really do not understand the distinction between "epidemic" and "endemic," and all those phrases that are used, "Why, I drove my horse that was perfectly well to the city, day before yesterday, and when I got him home, he was attacked." Well he might have been, because he had been exposed to the very atmospheric influences which have produced the disease throughout the land, wherever it has spread.

Then, in relation to horses drinking acids. It is a fact that all horses will drink acids more or less, if they can get them; all our horses cannot afford it. They will drink new cider and old cider, and I remember seeing, in a work which I was consulting in relation to this very disease in England, in 1792, the statement that it was the custom there to give horses malt and malt liquors, and they drank the malt liquors to excess; as some people now do. If a horse is afflicted with pneumonia in its first stages, you cannot compel him to drink stimulants or acids, or anything else, unless the morbid condition of his appetite induces him to drink them when he would not drink anything else. So far as regards the use of gin, it is very well; that is not to be left out; it is an excellent stimulant for a horse as well as for a man, in sickness. There have been altogether too many remedies used; it has been a hap-hazard business; everybody has been trying them; everybody in the community owns a good horse, or calls it a

good horse, and when he has been taken sick, he has been pampered, blanketed, fed with mash, with apples, with ginger and molasses, and everything else almost. So far as regards the general treatment, it has been abominable, as I remarked before. Let your horse alone, unless he is sick; if he is absolutely diseased, take care of him, and not until then. We hear of a thousand horses being attacked in one day in the city. That is not capable of being explained on the theory of contagion.

Dr. STURTEVANT. I believe this disease is contagious, and the seeming fact which leads me to believe it is that it breaks out just in those places where you would expect it to break out, if it were contagious. The livery stables, and those places which have daily communication with market towns seem to get it first. All those places which have frequent communication with Boston are found to have been visited by the disease, and there are other facts which I might mention, which lead me to believe that it is contagious. In regard to the treatment, we hear a great many conflicting views. Some believe in exercising the horses, and others believe in keeping them shut up in the stable and pampering them. I can give an instance from very good authority. The superintendent of the largest express company in New York city had a very valuable private stud of horses at the time the distemper broke out in New York. He gave orders that the horses of the express company must be used as long as they could be reasonably used; in other words, as long as they could be kept out of the hands of Mr. Bergh. In regard to his own horses, he gave orders that they should have the best of care, —and I have no doubt that they did have all the care and all the pampering that wealth could furnish them,—and his own horses suffered very much more severely than the horses of the company.

Dr. FAY. I should like to ask the gentleman who has just taken his seat, what he means by contagion and contagious disease.

Dr. STURTEVANT. I mean by contagious disease, a disease which is carried by contact with some virus, which can be recognized in this case, to the animal which receives it. For instance, if this matter which passes from the nose of a dis-

eased horse is conveyed, either by the clothes of an individual, or by contact with the horse, or is deposited upon the hitching-post, and thus comes in contact with another horse, and that horse receives the disease, I should call that evidence of contagion.

Dr. FAY. If that be true, I should like to inquire if this disease is a contagious disease and communicated as a contagious disease of the character which the gentleman states, how he accounts for the fact that the horse which was at the bottom of the central shaft of the Hoosac Tunnel should have contracted the disease, or the horse that was kept in the upper story of a building in Boston for seven years should have taken the disease. I would like to inquire whether it is contagious by coming in contact with the animal itself, or coming in contact with a place which is infested by the distemper.

Dr. STURTEVANT. I do not know anything about it, absolutely, but it is very easy to believe that the man who had charge of this horse in the attic in High Street, may have come in contact with other horses and carried the contagion to him; and the same explanation may be made in regard to the care of the horse in the Hoosac Tunnel. I have no means of knowing how he was exposed; whether the man connected with him came in contact with a horse that had the disease, or not. It depends upon the transmission of a certain matter from one diseased horse to another; whether it is conveyed in one way or another, by the intervention of a hitching-post, by the clothing of the hostler, or by germs carried through the air, seems to me immaterial. I think very likely it is partially epidemic, but that it is contagious seems to me very clear, from the fact that it seemed to follow the lines of communication first; and then we had cases which appeared to be epidemic; but they were not sufficiently excluded from other cases to establish a scientific law.

I will state another fact. Our farm is so situated that when the epidemic broke out in our neighborhood, we could very easily keep our horses, some nine or ten, from contact with other horses, and our men, having steady habits, not going off the place much, were not very likely to come in contact with diseased horses. We had the disease about us on every side, but we escaped until the fire broke out in Boston,

when my brothers took one of the horses and drove in to look after our interests there, on Sunday. On Monday, the horse was driven back again, and on Tuesday the disease broke out in our stable, and has attacked all our horses in turn. But these few facts prove nothing; they only give countenance to one view or the other.

Adjourned.

THIRD DAY.

THURSDAY, December 5, 1872.

The Board met at half-past nine o'clock.

Mr. NEWTON S. HUBBARD, of Brimfield, was requested to occupy the chair; and, upon taking his place on the platform, said: I thank you for the compliment of calling me to preside over your deliberations to-day. We have been feasting for the past two days on strong meat, and from the programme before us to-day, which closes the exercises of this meeting of the Board, it seems that we are to have yet more of the same substantial food. We have with us one who will speak upon the manufacture and application of fertilizers. These form the ground-work of all our farm operations in New England. Without these fertilizers farming would be entirely useless. I introduce to you Mr. ANDREW H. WARD, of Boston, who will speak to us this morning upon that subject.

MANURES AND FERTILIZERS.

It is well known that in the early settlement of Massachusetts the land produced without manure much larger crops than we now raise with manure, and the reason given is that the crops grown have taken vital elements from the soil which are needed to produce the crops, and that more of the elements have been abstracted than have been returned, and most of the land has been decreasing in agricultural value, and now we cannot compete with the West, except in such crops as are low in price and bulky, on which the freights enable us to retain our market for these products.

This state of things is not confined to Massachusetts. The same system has pervaded the Union. Not many years since, probably within the recollection of all here present, our best wheat was produced in the Genesee Valley, New York, but

has been constantly going west ever since; and now the Pacific is reached, the same system pursued, and lands which originally yielded forty bushels of wheat per acre, now yield but twenty.

It is only a question of time when this system of agriculture must end; consequently, where the land needs it, there it will, or should be, commenced. Where is it more needed than in Massachusetts?

We formerly raised stock and found it profitable. Our farmers depended upon a fat ox or cow in the fall to pay in part their expenses; but now how different. Cattle from Texas compete in our own markets with our own herds, for the reason that our lands do not bear grass to enable us to feed our stock to compete with them, and for the noble Shorthorn we raise other and smaller breeds of stock which can thrive on poorer pastures.

These remarks are general and do not apply to our rich valley and bottom lands.

Can this state of things be changed, and our agricultural interest be made to thrive and prosper as our mechanical, manufacturing and commercial has? They should all go hand in hand, and each is productive of the others' good; but the chief of all is agriculture.

With the same attention, knowledge, energy and skill applied to this branch of industry it will progress as well; agriculture will take its stand as an exact science, and cultivation of crops can be entered upon as an art with as much certainty as any other manufacture; and from these deductions we are led to consider whether the elements which have been abstracted from the soil can be replaced at a cost that the crops grown will pay for the materials used, the labor bestowed, and leave a margin for profit.

This brings us to the question assigned,—manures and fertilizers, and their application.

The term manure is applied to all those substances which render soils more fertile.

Manures produce their effects by contributing directly to the nutriment of plants, by improving the texture of soils, or by acting as chemical agents on the inert matters of the soil by which they are transformed into a state fit for the use of plants.

The raw material of crops is manure, and barn-manure is the type by which others are compared, and in many cases stock is kept expressly to manufacture it to keep up the value of the farm. Fodder is raised, not with a view to obtain meat, but in order to have dung; and it should be known what it costs to make it, what it is worth when made in comparison with other, the value of it to use, and for what crops it is best adapted according to what it is fed, and whether to growing, milk or fattening stock will its value be; and the variations are large, as will be noticed by the following table of the value of the manure made from different materials or crops :—

AVERAGE *Composition, per cent. and per ton, of various kinds of Agricultural produce, etc.*

Number.	ARTICLES.	PER CENT. Total dry matter.	PER CENT. Total mineral matter (ash).	PER CENT. Phosphoric acid.*	PER CENT. Potash.	PER CENT. Nitrogen.	LBS. PER (LONG) TON. Total dry matter.	LBS. PER (LONG) TON. Total mineral matter (ash).	LBS. PER (LONG) TON. Phosphoric acid.*	LBS. PER (LONG) TON. Potash.	LBS. PER (LONG) TON. Nitrogen.	Value of Manure f'm 1 ton (2000 lbs.) of food.
1	Linseed cake, . .	88.0	7.00	4.92	1.65	4.75	1,971	156.8	110.2	37.0	106.4	$19 72
2	Cotton-seed cake, .	89.0	8.00	7.00	3.12	6.50	1,994	179.2	156.8	70.0	145.6	27 86
3	Rape cake, . .	89.0	8.00	5.75	1.76	5.00	1,994	179.2	128.8	39.4	112.0	21 01
4	Linseed, . . .	90.0	4.00	3.38	1.37	3.80	2,016	89.6	75.7	30.7	85.1	15 65
5	Beans, . . .	84.0	3.00	2.20	1.27	4.00	1,882	67.2	49.3	28.4	89.6	15 75
6	Pease, . . .	84.0	2.40	1.84	0.96	3.40	1,893	53.8	41.2	21.5	76.2	13 38
7	Tares, . . .	84.5	2.00	1.63	0.66	4.20	1,892	44.8	36.5	14.8	94.1	16 75
8	Lentils, . . .	88.0	3-00	1.89	0.96	4.30	1,971	67.2	42.3	21.5	96.3	16 51
9	Malt dust, . .	94.0	8.50	5.23	2.12	4.20	2,106	190.4	117.1	47.5	94.1	18 21
10	Locust beans, . .	85.0	1.75	–	–	1.25	1,904	39.2	–	–	28.0	4 81
11	Indian Meal, . .	88.0	1.30	1.13	0.35	1.80	1,971	29.1	25.3	7.8	40.3	6 65
12	Wheat, . . .	85.0	1.70	1.87	0.50	1.80	1,904	38.1	42.0	11.2	40.3	7 08
13	Barley, . . .	84.0	2.20	1.35	0.55	1.65	1,882	49.3	30.2	12.3	37.0	6 32
14	Malt, . . .	95.0	2.60	1.60	0.65	1.70	2,128	58.2	35.8	14.6	38.1	6 65
15	Oats, . . .	86.0	2.85	1.17	0.50	2.00	1,926	63.8	26.2	11.2	44.8	7 70
16	Fine pollard, . .	86.0	5.60	6.44	1.46	2.60	1,926	125.4	144.2	32.7	58.2	13 53
17	Coarse pollard, .	86.0	6.20	7.52	1.49	2.58	1,926	138.9	168.4	33.4	57.8	14 36
18	White bran, . .	86.0	6.60	7.95	1.45	2.55	1,926	147.8	178.1	32.5	57.1	14 59
19	Clover hay, . .	84.0	7.50	1.28	1.30	2.50	1,882	168.0	28.0	29.1	56.0	9 64
20	Meadow hay, . .	84.0	6.00	0.88	1.50	1.50	1,882	134.4	19.7	33.6	33.6	6 43
21	Bean straw, . .	82.5	5.55	0.90	1.11	0.90	1,848	124.3	20.2	24.9	20.2	3 87
22	Pea straw, . .	82.0	5.95	0.85	0.89	–	1,837	133.3	19.0	19.9	20.2	3 74
23	Wheat straw, . .	84.0	5.00	0.55	0.65	0.60	1.882	112.0	12.3	14.6	13.4	2 68
24	Barley straw, . .	85.0	4.50	0.37	0.63	0.50	1.904	100.8	8.3	14.1	11.2	2 25
25	Oat straw, . .	83.0	5.00	0.48	0,93	0.60	1.859	123.2	10.7	20.8	13.4	2 90
26	Mangel-wurzel, .	12.5	1.00	0.09	0.25	0.25	280	22.4	2.0	5.6	5.6	1 07
27	Swedish turnips, .	11.0	0.68	0.13	0.18	0.22	246	13.4	2.9	4.0	4.6	91
28	Common turnips, .	8.0	0.68	0.11	0.29	0.18	179	15.2	2.5	6.5	4.0	86
29	Potatoes, . . .	24.0	1.00	0.32	0.43	0.35	537	22.4	7.2	9.6	7.8	1 50
30	Carrots, . . .	13.5	0.70	0.13	0.23	0.20	302	15.7	2.9	5.1	4.5	80
31	Parsnips, . .	15.0	1.00	0.42	0.36	0.22	336	22.4	2.9	8.1	4.9	1 14

* Reckoned as Phosphate of Lime.

The following experiments, conducted with great care at the barn connected with the Merrimac Print Works, in Lowell,

a single cow, being only an average producer of dung, was selected from the fifty cows usually kept at the establishment. She was fed as usual, and as the other cows were. The food and water was weighed for seven days. She consumed in this period,—

Water, ...	612 pounds.
Potatoes, ...	87 "
Hay, ...	167 "

A total of 866 pounds food and drink, and voided, free from her liquid evacuations, 599 pounds of dung; a cord of it, pure as dropped, would weigh 9,289 pounds.

Estimating for twelve months, a cow would consume,—

Of Water, 31,824 pounds, . . .	$0 00
Potatoes, 2,262 "	11 31
Hay, 4,342 "	43 42
Pasture, six months, ...	15 00
Labor and care, 10 cents per day, . .	36 50
Estimated cost of keeping cow one year,	$106 23

The products, estimating the same quantity of dung from the pasture as from the other feed, would be,—

Calf, ...	$5 00
2,500 qts. of milk at 3 cts. per qt., . .	75 00
Cost of dung (31,145 pounds, if all saved), to balance, ...	26 23*

When milk is converted into butter and cheese, it takes about fourteen quarts of milk to make one pound of butter, the average price of which is twenty-two cents per pound. Fourteen quarts of milk to three pounds cheese, average price nine and three-quarter cents per pound, thus netting about two cents per quart for milk.

These estimates each will form, according to circumstances, demand for milk, difference and cost in feed and quantity fed. Each should estimate according as he is situated; but cost, quality and value should be known, or at least approximated

* Its value, by the table, would be but $15.63.

to. From the estimates made, it follows that to keep stock to make dung will not pay, as twenty pounds of soda-ash to one cord of peat will equal one cord of manure made by a milch cow fed on potatoes and hay, and will not cost as much to produce it as it does from the cow.

Age reduces the quantity of fresh manure, as follows:—

100 loads lose in bulk	in 81 days,	26.7,	or become	73.3
	in 285 "	35.7,	"	64.3
	in 384 "	37.5,	"	62.5
	in 499 "	52.8,	"	47.2

In sixteen months the quantity has been reduced to less than half and the most valuable salts lost. The reduction in weight depends upon two causes: the elimination of gases by fermentation, and the loss of soluble matters by drainage, —the latter, least feared, being the most serious.

The following table shows the loss sustained in twelve months by 2,838 pounds manure put in a heap in the usual way, and exposed to the weather:—

	Put up Nov. 3, 1854.	Apr. 30, 1855.	Aug. 23, 1855.	Nov. 15, 1855.
Weight of manure in pounds,	2,838	2,026	1,994	1,874
Amount of water in manure,	1,877.9	1,336.1	1,505.3	1,466.5
Amount of dry matter in manure, ...	960.1	689.9	488.7	407.5
Consisting of soluble organic matter, ...	70.38	86.51	58.83	54.04
Consisting of soluble mineral matter, ...	43.71	57.88	39.16	36.89
Consisting of insoluble organic matter, ...	631.07	389.74	243.22	214.92
Consisting of organic mineral matter, ...	214.94	155.77	147.49	101.65
	960.10	689.90	488.70	407.50

The amount of nitrogen, and its equivalents of ammonia, in the preceding soluble and insoluble organic matter, is as follows:—

Soluble Organic Matter.

Containing nitrogen, . .	4.22	6.07	3.76	3.65
Equal to ammonia, . .	5.12	7.37	4.56	4.26

	Insoluble Organic Matter.			
Containing nitrogen, . .	14.01	12.07	9.38	9.38
Equal to ammonia, . .	17.02	14.65	11.40	11.39
Total amount of nitrogen in the manure, . . .	18.23	18.14	13.14	13.03
Equal to ammonia, . .	22.14	22.02	15.96	15.75
The manure contains ammonia in a free state, . .	0.96	0.15	0.20	0.11
The manure contains ammonia in the form of salts, easily decomposed by quicklime, ...	2.49	1.71	0.75	0.80
Total amount of organic matter, ...	701.45	476.25	302.05	268.96
Total amount of mineral matter, ...	258.65	213.65	186.65	138.54

In addition to the cost of making barn manure where it is made specially, or reckoning it at the price you can sell at or buy for, is to be added the cost of carting and spreading, which is no small item, and adds much to the labor of the farm and team to be kept to transport it, to say nothing of the liability of infesting the ground with weeds and noxious herbs which it all contains to a greater or less extent.

To understand the part which manures play in rendering soil productive, recourse must be had to the analysis of the plants themselves. The composition of these will necessarily indicate the materials which must be supplied in order to promote their healthy growth.

Where soils are submitted to the action of fire, there is an organic part which burns off completely, and a residue left incapable of combustion, consisting of mineral substances.

The same result follows the action of heat on plants; healthy plants invariably contain a certain number of these mineral ingredients, and in fact always the same substances, the nature and quality or the varying proportions of which are ascertained by finding the composition of the ashes of the plants.

The organic portion dissipated by the heat consists mainly of the elements,—carbon, hydrogen, nitrogen and oxygen,—which produce by their union the various proximate principles of which plants are composed. The development of a plant

therefore requires the presence of bodies capable of furnishing carbon, nitrogen, water and its elements, and the mineral matters which are likewise essential to vegetables. The latter can only be derived from the soil, but the supply of the elements which form the organic parts may be quite independent of the soil.

Lichens, which at one time were supposed to be destitute of roots, have been shown to be possessed of these organs with seemingly greater power than those of trees and herbs, for they are able to disintegrate and take up the necessary portions of the rocks to which they are attached, and fix them as part of their constitution. Their organic constituents under these circumstances can only come from one source, namely, the atmosphere.

The different substances necessary to the growth of a plant, or the different articles of their food, are all of equal value; that is to say, if one out of the whole number be absent, the plant will not thrive; the soils which are proper for the cultivation of all sorts of plants, contain all the mineral constituents necessary for them.

But of two soils containing equal quantities of these mineral ingredients, one may be considered rich and fertile, and the other poor or barren, if in the former case they are present in a form soluble in water, and in the latter are insoluble.

All soils adapted for culture contain the mineral food of plants in these two states; the quantity of the soluble ingredients can be increased from the insoluble; in other words, the soil made more productive by mechanical means; but land in which the necessary mineral constituents are not present in any form, cannot be rendered fertile by ploughing.

As different plants require for their development in some cases the same mineral substances, but in unequal quantities, a soil may become barren for one kind of plant, when by a series of crops one only of these constituents, as for example, soluble silica, has been so far removed, that the remaining quantity is no longer sufficient for a crop; but it may still contain sufficient mineral constituents for another kind of crop which does not require soluble silica; a third sort of plant may thrive on the same soil after the second, if the remaining

mineral constituents suffice for a crop of it. Upon this fact depends the rotation of crops.

The substances necessary to the life of a plant must act together within a given time, if the plant is to attain its full development in that time; the absence or deficiency or the want of available form in one necessary constituent is indispensable; but fertility is communicated if that one substance be added in due quantity and available form.

The supply of more atmospheric food, namely, carbonic acid and ammonia, by means of ammoniacal salts and humus than the air can furnish, increase in a given time the efficacy of the mineral constituents in the soil.

In a soil rich in the mineral food of plants, the produce cannot be increased by adding more of the same substances.

In a soil rich in the atmospheric food of plants, rendered so by manuring, the produce cannot be increased by adding more of the same substances.

The continued fertility of a soil for all kinds of crops, depends on the constant return to it of all the mineral constituents removed by the different crops.

Farm-yard manure is taken as the type of manures, because it contains all the constituents removed from the land, and again restored to it in a form in which they can be made rapidly available.

The carbonic acid and salts of ammonia produced by its decomposition, cause water to dissolve more rapidly the mineral constituents.

An artificial manure can be theoretically compounded to take the place of farm-yard manure; but it must contain all its mineral constituents. The farmer must return to the land whatever has been removed from it, for none of the constituents of a rich soil can be removed without making compensation, but at the cost sooner or later of impairing its fertility.

As bones furnish only two substances to crops, science as well as experience indicate that they are more likely to be useful when used as auxiliaries, for example, with farm-yard manure; if the soil is deficient in bone earth, the first application will produce good results; a constant repetition is productive of no increased fertility, but by the addition of

other mineral constituents necessary, the accumulated stores of bone earth will immediately begin to develop.

In the shape of the agricultural produce of a field, the entire amount of these constituents which have become ingredients of plants, is removed from the soil.

After a series of years and a corresponding number of harvests, the fertility of the soil or field diminishes; the change which is found to have taken place in the composition of the soil after harvest, is the probable cause of its diminished or lost fertility.

By means of solid or liquid manure or the excreta of men and animals, the lost or diminished fertility is restored.

Solid or farm-yard manure consists of decayed vegetable and animal matter which contains a certain proportion of the constituents of the soil; the excrements of men and animals represent the ashes of the food consumed, and which has been derived from the soil.

The urine contains the soluble, the solid excreta the insoluble constituents of the soil derived from the crops, used as food, and reaped from the soil.

By adding these to the soil, it recovers those constituents which have been removed from it in the crops.

Thus the restoration of its original composition is accompanied by the restoration of its fertility; it is therefore certain that one of the conditions of fertility in a soil is the presence in it of certain mineral constituents.

A rich and fertile ground contains more of these than a poor, barren one does.

Vegetable and animal matter and excreta when in the soil, undergo putrefaction and slow oxidation; the nitrogen of their nitrogenized constituents is changed in the putrefaction and decay into ammonia, and a small part into nitric acid, which is the product of the oxidation or decay of ammonia.

In animal manures, therefore, not only are plants supplied with the mineral substances which the soil must yield, but they are also supplied with those parts of their food which the plant obtains from the atmosphere; the latter supply is a clear addition to that which the air at all times affords.

In applying barn manure, some use it in large quantity and

do not repeat till the land is exhausted. The better way is to give it in more moderate quantities, and repeat it often.

The quantity used will vary according to the nature of the soil, the quality of the manure, and kind of crop.

The best mode of application is to spread the manure as early as possible on the surface of the ground, at a time when it is not saturated with moisture or bound up with frost, but in a season of frequent showers.

The soluble organic and mineral ingredients will in from ten to fifteen days, according to the amount of rain, be washed into and retained by the soil, and the insoluble matters can then be covered by the plough.

The method of depositing the manure on the field in heaps, and leaving it so for a length of time, is a bad practice; the soluble matters are washed into the ground, under and immediately adjoining the heaps, and cannot afterwards be evenly distributed by rain through the soil; hence, the result is inequality in the crops of such fields.

On light soils, mineral manures which contain their phosphates and alkalies in the most soluble state, should be applied in the spring; on heavy soils it will answer to apply them in the fall, but before the ground freezes.

It has been thought advisable to have varied and thorough trials of mowing and other machines under the auspices of the state or county agricultural societies, and the effect has been of benefit to the agricultural community, and productive of no injury to the manufacturers, and all our interests have felt the benefits conferred. Would not still greater benefits follow by a thorough and systematic course of comparative experiments of manures and crops, which will be practical and all can see and understand?

If the State Board of Agriculture suggest it to the county societies to institute them, with a recommendation also to the societies to offer liberal premiums to the various farmers' clubs to carry out the same experiments, no doubt it would be done by many, if not all, and we should have many reports from different parts of the State on different soils, temperature and rain-fall, and the results would furnish a foundation from which the farmers could build an actual knowledge, and

their interests would be helped to keep pace with the other interests of Massachusetts; and all combined, each successfully prosecuted, one would aid the others. Where agriculture, commerce, manufactures and the arts all flourish, there is a model State. May this be true of Massachusetts.

I will venture to suggest a plan, simple yet practical, to test not only various manures, but on various crops, one of which, flax, was formerly raised here, but is now limited. We are dependent upon foreign countries for a supply to keep our mills in operation, and if it can be successfully raised here, and at a cost to compete with the imported, with an ample stock constantly in the market, the manufacture would increase, furnishing employment in the manufacture of the article, as well as improvements to our farms in furnishing a crop for which we have a home market, with a prospect of a steady increase in the demand.

Could this be carried out there would be no occasion to turn our attention from our depleted soils to others to exhaust, but renovate our own,—and it can be done,—and our farms worked and increased in value; and as a consequence of it, wealth and population added to the State.

The Agricultural College is doing vast good, its benefits to the community at large are unspeakable, and are as yet but the opening leaf, to be followed in due time by the full ear. It has awakened an interest not confined to Massachusetts in the manufacture of sugar from beets, and the results of the experiments on this crop, to be followed, we hope, with experiments on other crops with various manures, will be looked for with interest not only by our own farmers of Massachuchusetts, but the whole Union.

Plan of Crops and Manures.

	Grass.	Wheat.	Rye.	Barley.	Oats.	Flax.	Tobacco.	Corn.	Potatoes.	Cabbages.	Turnips.	Beans.	Carrots.	Beets.	Onions.
No manure, ...															
Three loads barn manure, . . .															
Six loads barn manure, ...															
Ten bushels of ashes, ...															
Ten bushels leached ashes. . . .															
Three loads barn manure and five bushels leached ashes, ...															
Commercial manures (100 lbs. each), .															

The CHAIRMAN.—This is a subject in which every agriculturist feels an interest, and it is one upon which every one has more or less real knowledge. We are here for the interchange of opinions, and to give the results of actual experience. Theory is very good, but when we have theory and practice combined, we get the real benefit we are after. I hope you will be free in the discussion of this question, and in the interchange of opinions with regard to the matter.

President CLARK. I was riding with a farmer yesterday, and he said it seemed to him that this was the most important question for the Board of Agriculture to consider, and he was very glad that the topic was to be brought up, and hoped it would be very thoroughly and ably discussed. We heard yesterday from Professor Agassiz that the important point was *to know;* that mere opinions were only matters to talk about, to quarrel over; and in this age of the world, after such men as Liebig, Ville, Lawes and Gilbert, and many others in different countries have been for thirty years experimenting, and have subjected all crops and all manures and all soils to analysis, it has come to this: that in almost every country where commercial fertilizers are used, and they are used very largely, nothing can be sold except on the publication of its analysis; and in Germany there are, as there should be everywhere, chemists appointed to analyze and detect fraud in commercial fertilizers, so that if a fertilizer does not come up to the manufacturer's standard,—does not came up to what he says it will by actual chemical analysis by a disinterested party, —he is liable for the damage he has done, and liable to punishment for the commission of a criminal offence. We all see what terrible damage may be inflicted upon the agricultural community by the sale of commercial fertilizers which are not what they profess to be; for, as has been said by Mr. Ward, a man wastes not only the money which he pays for the manure, but he loses his labor and his income for the year. The loss is very hard to calculate. It has seemed to me that the time had come when we should have a law that should make it a criminal offence to offer anything for sale in the State of Massachusetts as a commercial fertilizer that did not bear upon every package a printed analysis, sworn to, and that there should be a state chemist appointed, under the direction

of this Board of Agriculture, whose business it should be to take these fertilizers as they are sold in the market, whenever and wherever he pleases, and analyze them, and if any fraud is discovered, the manufacturer should be liable to prosecution and punishment as a criminal, not merely as a man who has sold something for more than it was worth, but as a man who had committed a great fraud upon the community. The point is not what a man has paid more than the thing is worth; but the question is, What injury has that fraud inflicted upon the community?

Understand me. I do not say that there is any fraud about these things. I am speaking upon general principles. I am saying that it is *knowledge* you want. I am saying that there is science enough in Massachusetts to-day, so that we need go upon nobody's opinion. We may know exactly what we put upon our land, and how much it costs, and then we shall be prepared to know about how much it is worth. But so long as we go upon opinions, so long as we buy fertilizers without knowing what they are made of, so long as Tom, Dick and Harry spread them upon all sorts of land, in all seasons, and use them with all sorts of seed and all sorts of cultivation, we do not know any more when we get through than we did when we began. We must have a foundation on which to build, and the means of obtaining this foundation we have to-day in the Commonwealth of Massachusetts. We may know every item that enters into the composition of the various fertilizers for which such enormous sums of money are paid every year in this State. In my vicinity where the tobacco fertilizers are bought, it amounts to hundreds of thousands of dollars. The way in which those men waste their money is amazing. Farmers buy whatever is offered. They will buy of this man and that man and the other man. It is a positive fact that our tobacco growers will put three kinds of fertilizers on the same field. They are always sure to get enough of something. They put on a good lot of barn-yard manure, and they boost the plants with anything they can buy, they do not care what it is made of. What they are after is tobacco; they expect a profit of three hundred dollars an acre, and they do not stop to ask what they are buying. They throw their money away as if it were nothing but gravel. Now that ought

not to be. This Board of Agriculture ought to do something to stop it. We ought to know what we buy for fertilizers, and there ought to be a law to punish any man as a criminal who sells an article as a commercial fertilizer that is not what it purports to be. He may charge what he pleases, but he ought to be compelled to show what there is in it, and then people may buy it or not. There are many things sold which are not worth anything like what our farmers pay for them, and there are a great many things sold which are absolutely injurious. I may say here in this connection, what I said yesterday, that Professor Agassiz uttered the most eloquent words I had heard, when he said, "I do not know." That is what is the matter with us all. The trouble is we do not stop to know. The trouble between farmers and scientific men is just here,—that farmers imagine that scientific men know everything, but they are so stuck up they won't tell them what they know. You think if it was not for that we could tell you how to raise corn for twenty-five cents a bushel, and all such nonsense. But that is not the fact. The trouble is, we do not know. I was glad to hear Professor Agassiz, who stands at the head of the learned men of the country, say here, "I do not know." When he says, "I do not know," he means *we* do not know, and the rest of us can stand it after he has said it. Now I would simply ask that we may try to know something, that we may try to apply science to some useful end. One difficulty in the way of progress comes from the fact, that the farmers of this Commonwealth are not yet waked up to the idea that it is necessary to spend any money, or to spend any brains to learn anything. The fact is, knowledge does not come for the asking. There is no royal road to learning; it must be gained through mental discipline, study and experience. We have got to work it out. That is the only way in which we can get it. And who is going to do it? The man who is paid for it. Do you suppose men are going to spend all their time in working for the public good and be starved to pay for it? Not much! Men of science can earn a living by lecturing for a hundred dollars a night about something that is simply entertaining, if they cannot be supported in doing some useful work; but I would rather do something which shall be of lasting benefit to the

people of the country and to the world. Now the State of Massachusetts has a proper agricultural station. We do not want experiments made upon everybody's land, in all sorts of ways. The only experiments that will be of any use or benefit to the world are experiments made by men of the highest science. They must be made by men who know whereof they affirm, who know enough to take into consideration all the circumstances which affect the result; who are able to tell what the soil is, what the manure is, and what the crop is from beginning to end; and you cannot have that except you have the best-educated men who can be found; and when you have secured the best of them for the service, you will have some mistakes. Nobody is perfect, and you must not be afraid of having too much knowledge or too much time and money spent in getting information. What we need is the means of establishing at our Agricultural College such an experimental station. Not that *we* need it; we do not need it. We are living along there first rate. We do not work half so hard as we should if we had more money. What we want is money to establish such an experimental station as will enable us to make all these experiments. The general plan suggested by Mr. Ward is a good one; but we do not want these experiments made by ignorant men. We do not want them made in such a way that one crop shall take from another crop. If I were going to modify his plan, instead of bringing my plots of land contiguous, I would have a blank space between every two squares. Otherwise the plants will lap over from one into the other, and so there would be a great many possibilities of mistake. These possibilities are to be avoided, and they cannot be avoided unless we bring as much knowledge to bear upon the case as possible.

In Europe these experimental stations have been established and been at work for a great many years. They have accomplished extraordinary results, and those results are felt by the farmers of Europe. The farming of Germany has increased in its profits wonderfully in the last twenty years, and very largely through the influence of these experimental stations. There can be no question that these things will pay; for as I said last night in my lecture, the least real development in agriculture is of infinite value. Whoever can increase the

agricultural products of Massachusetts one per cent. increases the value of the crops almost seven hundred thousand dollars over their value at the present time. That is a very appreciable difference, and it will keep up an experimental station forever. There can be no question of its success. Who will doubt that a first-rate experimental station, where you should have a first-rate chemist, a first-rate physiologist, a first-rate botanist and entomologist at work, and going up and down the State for the benefit of agriculture and horticulture,—who, I say, can doubt that such an institution would, sooner or later,—give it what time you please,—increase the agricultural products of Massachusetts one per cent. without any increase of cost, and that at once pays for the thing, so that it can be begun to-day and run forever?

Now what I would like to know in regard to this question which we have under consideration is, What do the manufacturers guarantee that the fertilizers, which they sell at fifty dollars a ton, shall contain? I do not understand that we could safely put much money into them unless we know that. I would like to know how much soluble and insoluble phosphoric acid, how much potash, how much lime, how much ammonia they propose to furnish for the fifty dollars; and then I can tell whether I want to buy them, and I shall not know until I have that information. The sources of all those substances are known to mankind in general.

The fundamental substances in all valuable manures have their sources in the ashes of plants, in the mine, and the vegetable and animal remains, which can be used for these purposes; and it is our business as purchasers and users of fertilizers, to know what they contain before we put our money into them; and certainly we should want more than one year's experience to settle the value of any fertilizer. What we want to know is, what the manufacturers will guarantee to furnish us of these substances in their fertilizers, and when we know that we can figure up to suit ourselves.

Mr. Lewis. This question of fertilizers is a very important one. I soon found out, after I commenced farming, that manure agreed with my land extremely well. I commenced with this understanding, however, that I would never reach out beyond my farm and purchase a pound of commercial

fertilizer until I had used all the manure I could make at home, and I think that is a very good rule for any farmer to adopt; that is, to use all the manure on his own place that can be obtained at a reasonahle price, and then, if he likes, purchase in the market the best he can find. I have almost always fallen short in the amount of manure I required or wanted, and have dabbled a little in commercial fertilizers; but still I have not gone into the trade with that degree of confidence which I should like always to have in my fellow-men. I would like to go into the market anywhere and purchase any article, and find it precisely what it was recommended to be.

Now, gentlemen, there is one little point upon which I must disagree with my friend who has just taken his seat; that is in regard to the experiments made in agriculture in order to establish facts. You cannot, here in Massachusetts, make experiments that will hold good in other sections. Some things I said to you last Tuesday may not be applicable to your cases here. Your soils differ from ours in Herkimer; your climatic influences are different, and an agricultural fact established in the north part of this town, may not answer even for the south part. This man's farm on one side of a ravine has a different soil from that man's on the other side of it; behind that hill or that piece of forest, the climatic influences are altogether different from what they are on a place a little bit elevated, with a similar soil. Again, the climatic influences are changed by some gorge running down between hills, so that the climatic influences are very different in different localities, and we as farmers, to a very great extent, must eventually, if we ever know anything, bring these facts out at our own homes, with the aids which these institutions will afford us. They must act as our aids, but we must act as principals, after all.

Again, an agricultural fact cannot be established, as my friend said, in one season, neither in a rainy season nor in a dry season, nor in one rainy season and one dry season put together. It takes ten years at least to establish an agricultural fact. Under the many changes of our climate, ten years is little time enough. You see how that places us. When we consider the isolated character of the farmer's life; how

little farmers talk together upon subjects in which their whole interests centre; how little they interchange views, except at the Farmers' Clubs, or some such places, it is astonishing we have made the progress we have. How different the farmer's life is from the life of those who represent the manufacturing and commercial interests! They are located mostly at the great manufacturing, commercial or financial centres, and if any danger threatens, a few hours will bring them all together and they will prepare to ward off the threatening danger. Let a promised good appear and they will seize it in twenty minutes from the time the first one knows it. They can combine not only their wisdom, but their capital. But the farmer stands isolated and alone. He stands upon his *independence!* He has been made to believe that he is "independent," you know! That has been the cry of our public speakers whom the farmers have called on to instruct them. They would begin by telling them how noble the farmer's life was, how "independent" they were. I say, we are the most dependent race under heaven, and these very men who tell us so, would never soil their hands by acquiring our "independence." Now, what I wish to say is this: I understand that you have a living, active Farmers' Club here in Barre. Is that so? Don't all speak at once!

Mr. Ellsworth. I am ashamed to say, it is living, but it is not active.

Mr. Root. Call on us next week, and we will show you.

Mr. Ellsworth. I speak of what is, I hope for better.

Mr. Lewis. If you have not a living, acting Farmers' Club here in Barre, you ought to have, and you ought not to lose any time in organizing one. And when you organize it, for heaven's sake don't get any useless machinery in. Never work any red tape into a Farmers' Club. Let the thing go on, as Col. Stone said yesterday, "free and easy." If a farmer prefers to read an essay sitting in his seat, or even to make a speech in the spread-eagle style, let him sit down. One of the best papers ever read before the Farmers' Club in Little Falls, was read by a man whose knees, when he stood up, began to shake and his voice to tremble. I said to him, "Davis, for heaven's sake sit down and take breath." That essay was published in most of the European papers,

and yet the farmer who wrote it had not courage to stand up and read it. Now, you have got just such farmers here. Let them sit down and they will make a good speech, but let them get on their feet, just as I am fool enough to do sometimes, and they will forget (as I do) what they were going to say, just like the boy of whom we have all heard, who went on an errand and kept repeating the three things he was to get until he fell down. Run your Farmers' Clubs in the simplest manner possible, and let this man take one crop to experiment upon, and another man take another crop, and some other man another, and let these experiments be carefully conducted, and everything noted. Do not trust to memory for a single thing, but put it all down in black and white, and compare the results; know every fact, and then you commence to lay the foundation for some agricultural fact that you will afterwards use. Continue this course until every man is fully satisfied in his own mind that he has fixed a starting-point. This is the way I think we must start. The Agricultural College will aid us immensely in this work. Let us be "free and easy" in our communications with the scientific men there. Don't let us entertain the opinion, if we have heretofore, that they are so stuck up they won't tell us what they know. They will tell us, and they will gladly aid us in our efforts, but we must work ourselves. Because we have established agricultural colleges is no reason why we should sit down and let our Professors do the work. They need our aid, and we must put our shoulder to the wheel and move it forward with them. We must work together; we must be co-workers. Now, gentlemen, let me say, that I have found hen-manure pulverized better than any commercial fertilizer I have ever been able to purchase, but I have found that more than one-half of the farmers in Herkimer County do not regard it as worth saving. How is it in Barre?

Mr. Ellsworth. Some of us know the value of it.

Mr. Lewis. I am glad to hear it. I will make a big chalk mark for you. Gentlemen, I say to you, I do not care whether you believe it or not, that I never used hen-manure on the corn crop without having benefited it more than all the corn the hens ate. Stick a peg there. It has added more to my corn crop than the amount sufficient to feed my poultry.

QUESTION. How did you apply it?

MR. LEWIS. I composted it with muck, if I planted on the upland.

QUESTION. In what proportions?

MR. LEWIS. About one part hen-manure to three of muck. But never mix it before you are ready to use it, and as soon as you use it cover it up. I put a hoeful of dirt between that and the seed-corn, and drop it no faster than I cover it up. If you mix dry hen-manure with muck, if the water is not all dried out, you will soon set the ammonia free. Heat is developed by putting them together, and that throws the ammonia, the fertilizing material, right out. So cover it as you go. I have used hen-manure on the beet crop, and made ten tons of beets for one bushel of hen-manure.

MR. WARD. Pardon me for rising again, but I want to reply to President Clark. I will state, in the first place, that in my experiments I have left a space between the plots, so that the crops would not run together. In regard to the analyses of various fertilizers, I will say that my remarks were general, and merely to establish certain principles in the application of manures. I was afraid the discussion would run to particular fertilizers rather than on general principles. It has always been supposed that having ascertained the composition of the various kinds of fertilizers by analysis, you would then know their effects on the soil; but all manures produce their effects by contributing directly to the nutriment of plants, by improving the texture of the soil, and by acting as chemical agents on the inert matters in the soil, by which they are transformed into a state fit for plants. Now, by a chemical analysis of a manure, you do not ascertain how it acts on the inert matters in the soil. Then I will state another thing in regard to what President Clark has said. It is a common occurrence with those persons who buy these various superphosphates in the market (and nearly all the fertilizers in the market are superphosphates, combined with nitrogeneous matters, to some extent), to find that the first year they produce great results, and the second year they apply the same thing, and the results are entirely inadequate. Then the farmer immediately turns upon the manufacturer of the superphosphate and says, "Why didn't you sell me as good an

24

article this year as you did last? It has proved utterly worthless." Now I believe that the manufacturer has sold the second year the same article that he did the first. The difference in the result is owing to the want of knowledge that has been spoken of. Farmers do not know what their soils actually need to produce the crops which they want. They put into the soil the first year certain substances that the soil needed. The second year it needed other materials that were not contained in the fertilizer used before, and if they had furnished those other materials, the crops would have been developed according to their liking. This only shows how important it is to the farmer, and to the manufacturer of manures, that each should know the other's want. That is the reason why I made the statement in my paper, that the benefit of the Agricultural College is incalculable to the farmers of Massachusetts. It is merely, you may say, the entering wedge; but while you carry that on, while that is working in its proper sphere, at the same time the farmers throughout Massachusetts should each lend a helping hand. Where can these experiments be better carried on than upon your farms, where you can see the practical results? That is what the farmer looks to. If he can see his crops growing before his eyes by the addition of various manures, if he can see that there is a difference between the results of two manures placed side by side, that is the thing that is important to him. The composition of the manures may be a blank to him. That is why I proposed this thing in this way. When you apply these different manures, you will know the analysis; or you may all know the analysis of them, because, by the laws of the Commonwealth, everybody who manufactures fertilizers is obliged to give the analysis; but, to my mind, a person gets but a very small idea of the value of these fertilizers by the analyses. They have got along so that they know that a certain amount of soluble phosphoric acid will produce thus and so; but if it is insoluble, it is inert matter in the soil, and is of no earthly avail. Now, my object in having these experiments tried in that way was, that where you have barn-yard manure, leached ashes, superphosphates, and various admixtures placed side by side, you have an opportunity for comparison. It is vitally important to the farmers in different portions of the

Commonwealth that these experiments should be tried by the different agricultural societies in the State, and I hope they will be. It has been suggested that the manufacturers of fertilizers might sell one thing for these experiments, and something else for general use. I would recommend that a sample of every one of the lots bought be retained, which the State Assayer can analyze; and when those results are recorded in each part of the Commonwealth on different soils, in different temperatures, and with different rainfalls, and certified to (because these are always the groundwork, the foundation on which you are hereafter to build), then, to prevent any mistake, in any way, go to your chemist, an impartial man, and ascertain the actual component parts of these things. When you know that on a certain soil, with a certain temperature, with a certain rainfall, certain ingredients produce certain results, then you have a foundation on which you can build.

President Clark. Mr. Ward has more faith in manufacturers of commercial fertilizers than I have. He thinks the fault is in the farmer's ignorance; but here we come again to a matter of opinion. He takes one side. He thinks the farmers are all wrong and the commercial-fertilizer manufacturers are all right. Well, some of us think the other way; that the farmers are all right and the commercial-fertilizer manufacturers all wrong. So we come right back to the point where we started. What we want is *knowledge*. It is not Mr. Ward's opinion, or your opinion, but positive *knowledge*, and that knowledge can be obtained as certainly as you can tell the time of day by taking your watch out of your pocket and looking at it. Professor S. W. Johnson, of the Sheffield Scientific School at New Haven, has published a book upon manures, which I think every farmer ought to have. He says that when he began the business of investigating, under the direction of the State Board of Agriculture of Connecticut, the composition of commercial fertilizers as sold in the market, he analyzed a sample of the most celebrated,—Coe's superphosphate,—and found that they were actually selling a manure which seemed worth more than they asked for it. At the price which the chemist takes for the different valuable ingredients, he was doubtful whether it could be

made with a single cent of profit. But he followed them up, watched them, kept analyzing their manufactures, and it was but a very short time, certainly not three years, before he found samples of Coe's superphosphate, which he took out of the packages on sale, which were not worth, by his analysis, one-quarter the price they were sold for. Now just look at the fraud,—the fraud not only in the loss of money to the farmers, but the loss of the use of land, labor and time; and very likely the whole of that manufacture was of that quality. I am not speaking of the present quality of Coe's superphosphate; that is not the point at all. This is only an illustration to show that, after all, even the most celebrated manufacturers cannot be relied upon. Positive knowledge is our only effectual security. You might just as well come and ask me to leave my doors unlocked, or to move my property out into the street, relying on the common honesty of mankind for its safety, as to let this business of manufacturing commercial fertilizers go on as it has gone. It is just like the liquor-business. Do you suppose there is a liquor-dealer who never watered his liquors? I do not. It is too much for human nature to stand, you know. I have as much faith in mankind, I hope, as other men. I try to be charitable and reasonable, but there are certain chances to defraud which you cannot permit a man to enjoy safely. Among these are the chances of the horse-jockey, the liquor-dealer and the commercial-fertilizer manufacturer.

One word now in regard to what my friend Lewis says. I do not want him to go away from Barre differing from me. He looks to me like a fighting-man, whom it would not be safe to meddle with, and I want to make up with him right on the spot. Mr. Lewis and I will not differ at all about this matter. The point I make is this: that it is not in the power of any farmer in this Commonwealth to make an experiment in regard to commercial fertilizers that shall have the value of an experiment made by scientific men. He says we have got to adapt our knowledge to our locality. I have heard that a great many times about the Agricultural College. It has been said, you may make the best practical farmers on that farm, and they will go off somewhere else and starve to death. That is all a fallacy. What we undertake to teach is the

scientific principles of agriculture and their application to farming of all kinds in various localities.

Mr. LEWIS. Train them up to get a good living and make money in Barre, and they will make money anywhere else.

Mr. WARD. One remark made by President Clark might leave the impression that I said that the manufacturers of fertilizers were not ignorant, but farmers were. What I wanted to say was, not only that farmers are ignorant of what they ought to use for their crops, but the manufacturers of fertilizers have not had sufficient judgment and knowledge to make fertilizers adapted to these different crops. I do not profess, in what I have said here, to know all things. Far from it. I feel that we are just at the entering point. President Clark stated that we wanted practical results; we wanted facts. I agree with him fully, and that is why I want to have these experiments made. That is the only way in which we can get at these facts. One person's opinion may be taken by some, and another person's opinion by others; but that amounts to nothing. We must devise something to "prove all things, and hold fast that which is good."

Colonel STONE. I have only a word to say. This war between farmers and the manufacturers of commercial fertilizers is nothing new. I have heard it for many years. I thought three years ago that we had given to the farmers an opportunity to protect themselves. If I recollect right, I served on the Committee on Agriculture in 1869. There was great ado made in regard to this very matter. Many farmers came before the committee and said that the farming community and the agricultural interests of the State were very much injured by the spurious fertilizers that the manufacturers were imposing upon them, and they asked for a law for their protection. We worked hard; we got all the facts we possibly could; we framed a law, and if I mistake not, friend Clark was consulted in the matter. He acquiesced in the general fault-finding, acquiesced in the necessity for a law for the protection of the farming community, and I think he almost promised that if the legislature would enact a good and sufficient law for the protection of the agricultural interests, they would analyze these fertilizers at the Agricultural College.

We made a law, as we thought, strong enough, and if I am not mistaken, that law stands to-day upon the statute book of Massachusetts for the protection of every man who buys a pound of any fertilizer. No manufacturer of a commercial fertilizer has a right to offer that for sale within the bounds of Massachusetts unless an analysis of the compound is attached to every package. But this law is very much like the temperance law; you will work hard to get a law, and the moment you get it, you fall back and will not support it. That is the whole trouble with the temperance law of Massachusetts. It is so in this matter; you have a law now sufficient for your protection; will you use it?

President CLARK. I am very glad that Colonel Stone has made known to the farmers here that they have a law. My point in regard to the law was, that it was not sufficient, because it did not make the offence a criminal one. The man who buys a worthless fertilizer can only get his money back. I say that does not cover the ground. It should be a criminal offence, and a man who sells a fertilizer which does not conform to the analysis upon the package, should be subject to fine and imprisonment. It is very desirable that even the existing law should be executed, and that it is understood that it is to be executed. I am very happy to say that we have been at work for three years experimenting upon fertilizers. We have a very large number of analyses, and the report is now being written by our distinguished professor of chemistry, upon that subject, which you will have the pleasure of seeing in print, if the legislature vote to print it.

Mr. LEWIS. For fear some of the people of Barre, with whom I have fallen in love,—I confess it,—may misunderstand me, I wish to make a little explanation. You know I said to President Clark, that if he would train up the young men at the college to get a living in Barre, they could get a living anywhere else. I did not mean to speak disrespectfully of Barre. You have some good farms, but you have some mighty hard farms to get a living upon. As I have seen them, I have thought to myself, "I am afraid if these farmers were placed in some portions of the Mohawk Valley, it would ruin every soul of them. They would work a few hours each day, and the balance of their time they could

afford to spend at the corner groceries and grog-shops. It would be the ruin of every man. They would fall into habits of idleness, have bad associates, and lots of them, and it would be their present and eternal ruin." Now, on the other hand, you put an equal number of Dutchmen from the Mohawk Valley in Barre, and every soul of them would starve to death in three months.

The CHAIRMAN. The farming community may not know all the steps to be taken in solving these problems in relation to manure, but there is one thing that we farmers would like to know in regard to these commercial fertilizers. It has been stated that a good article of superphosphate is worth fifty dollars a ton; that it requires three or four hundred pounds to the acre, and that the application is required every year. Now, we want to know what per cent. interest we are going to get for that amount of money invested; whether we are going to leave the soil in such a condition that we shall get the result for a long term of years, and get a good per cent. from year to year. If we can invest fifteen dollars per acre for a long term of years, and still keep the land in just as good condition to produce grass one year and another, and we can get a good interest for that investment, we are very well satisfied. These are things that the farming community want to know, and the scientific men will protect us with the laws we have.

Mr. J. B. MOORE, of Concord. I do not know as I can say anything that will add to what has been said upon the subject, except, perhaps, a word or two in regard to these certificates that come with the fertilizers. These fertilizer-men get letters from the best farmers, certifying that their fertilizers are good articles. The men who give these certificates are very much to blame in this matter. They do not give them understandingly. I do not mean to say that they do not state what is true, but I know there is hardly a month passes over my head that I do not have an application from some man who is manufacturing fertilizers, saying that he desires to send me a bag or a barrel that I may test it, and send him the result. Now, when they send out their fertilizers for the purpose of getting these certificates, they send an honest article, and that is the only time, the first time and the last that they do send

an honest article. I am afraid that is so. Now, I have declined to test anything of that kind for any fertilizer-man, I don't care who he is. If I wanted to test a fertilizer I should go into the market and buy some of it, and test it for my own satisfaction, as I do everything else. I do not want President Clark to test anything for me. I can tell what suits my land. I will buy some of the article and test it for myself. What I buy will be what they sell to the farmers generally; but I do not propose to lend my name to mislead the farmers of Massachusetts. I say that any man who tests these articles upon samples sent for him to try, wrongs the farming community. It is the leading, influential farmers of the State who do that, and they are helping these men along to-day. I hope they will not do it any longer.

I have used various fertilizers, and some of them to a profit. I use Peruvian guano every year for strawberries, because I know what will be the result of Peruvian guano. I have found it as safe as anything I can use. I have used for the last two years considerable quantities of lobster-waste, ground up, that I got of Mr. Underwood. I am satisfied that I get my money's worth there. That has not been adulterated so far, I think. Perhaps it won't pay for adulteration; it does not cost very high. I have used that lobster-waste at the rate of a thousand pounds to the acre. I sowed it on a half acre of ground that was seeded down a year ago last fall, where the growth was less than fifteen hundred pounds to the acre, and I have cut three heavy crops of grass this year from that application. Now, when I first proposed to purchase some of that fertilizer, I took the analysis to a friend in Boston, who is a rising chemist,—Mr. John M. Merrick,—and asked him if I should buy some of it. He told me that from that analysis he did not think it worth anything; but he was persuaded to try some of it himself, and he told me the result was wonderful, and greatly surprised him. Says he, "It only shows that we chemists do not know much about agriculture, after all." That is what I have been thinking for a good while. After all, I would rather test a thing myself. If it does well, I will use it; if it does not do well, I won't. I do not believe any chemist can analyze a plant and then analyze the soil, and tell you what you want in that soil in order to

make the plant grow. For instance, take the granitic soils here in Massachusetts, which contain considerable potash, which is insoluble, so that it is of no use to the farmer. If you take a lot of that soil to a chemist, he will analyze it with his strong acids, will bring out all that potash, and you have got potash enough according to his analysis, when you really have none. I would rather make my own tests, and if I find an article benefits me, I will buy it while they make it honest, and when they stop, I will stop; but I will not buy anything upon any of these certificates, because I do not believe they are worth anything. I believe they will mislead whoever relies upon them.

Now I would not have the audience understand that I do not think superphosphate is a good thing, because I believe it is one of the best manures used; but the trouble is that when you buy it you do not get an honest thing. Now if President Clark made that superphosphate and had no personal interest in it, I think it would be a good thing. But if he had any interest in it, I am afraid he would be corrupted just the same as the rest of us.

President Clark. I want to correct a mistake which my friend, Capt. Moore, has made in regard to this analysis of soils. I do not want any farmer to think that we do not know how to analyze soil better than he states. He tells you that we use very strong acids that liberate the insoluble potash in the soil. We do not do any such thing. I will tell you what we do. We first dissolve all there is that is soluble in water, and analyze that separately, and report so much that is soluble. Then we take a very dilute acid, and we dissolve what will dissolve in dilute acid, and analyze that separately; and then we have a little quartz and gravel, mere insoluble and useless stuff, and we weigh them; and when we make a report of an analysis of soil, we report just what the result is. I should be very sorry to have this audience believe, with Capt. Moore, that a chemist cannot tell anything about the soil, or what manure is applicable to a plant. It would be a most terrible blow to me if I had to believe that we must go on blundering through all future time, and that we should never know anything. We have been flattering ourselves that the result of Liebig's work is worth something;

that we do know how plants feed better than our fathers did; that we have learned what elements in the soil are worth nothing and what are valuable. Capt. Moore would buy phosphates and lime and potash, because he knows they will make plants grow. How came he to know it? Because chemists have analyzed plants, manures and soils, and found them there. He does not doubt it. He will not dispute it. What he means to say, and what Mr. Ward has said is, that we cannot always tell by the analysis of a given substance just what its effect will be on plants. That I will admit. I will admit that if I took a substance to a young man who had been in a laboratory, but never had been on a farm, and had no idea of the relations of manures with plants, and I was simply told by him what elements were in it, I should not get the information I wanted; but I believe that an experienced organic chemist like Dr. Goessmann, if you will take to him any manure you please, will tell you what its value is to the plant; will tell you what is soluble, what decomposable by the process of decay, what can be taken as plant-food, what will operate to make these insoluble granitic particles valuable, and tell you the whole story from beginning to end, and no man shall gainsay one word he says.

Now this is a very important point, that you, gentlemen, should believe in science; for if you do not, we had better "hang up our fiddle and bow," and go into some other business. If you cannot believe in the deductions of science, if there is no way to get at knowledge that we can stand on and swear by, then it is a hard case for us. I should rather be in some other business than trying to teach agriculture or trying to enlighten farmers, because it would seem we are never going to get beyond the mere point of opinion, and this everlasting flood of talk.

The point I wish to make is, that there are substances which have a value greater than the chemist can find in the analysis, if he is only to ascertain how much of each element may be in it. But any intelligent chemist, competent to make an analysis of a compound fertilizer, will not be satisfied with showing what the elementary constituents are. He will consider the whole thing; what organic matter is found, what its character is, what will be its action when we let it

decay, and then he will tell how useful it can be made to the farmer.

Let us then go on with our experiments and get the best results we can. I insist upon it that science will give us a sure foundation on which to stand; not that it will give us all the knowledge we want; not that we are going to find at the Agricultural College the measure of all horticultural and agricultural knowledge. That cannot be furnished upon one farm or by a few men. We want stations in various parts of the Commonwealth to test the value of discoveries made, but the fountain-head of knowledge must be where the scientific men are.

Mr. Moore. I think the professor of chemistry will not say that there are not living and life-giving principles in soils and plants which the chemists have not been able to detect and put their fingers upon and tell the farmer what they are; because if you will compare some of the first analyses of soils and plants with later ones, you will find they have discovered some new things. They have discovered things which they call new elements. They say they do not believe they are of much use, and I do not believe they are.

President Clark. If we should offer you rubidium and calcium you would not buy them for your farm.

Mr. Moore. No. I know that chemists will tell most of the things. I admit, and I have always been willing to admit, that you know from the analysis of the chemist most of the articles contained in the soil; but suppose it comes from a large field, you cannot take a small portion of that soil and get a fair representation of it in the analysis.

Adjourned to 2 o'clock P. M.

Afternoon Session.

MOWING AND PASTURE LANDS.

The Chairman. We have listened this morning to an address upon manures and commercial fertilizers, and to a thorough discussion of that subject. We come this afternoon to the discussion of the question of mowing and pasture lands; and while the question of manure is an important one, this also is very important to the farmer, because it relates to that crop

from which he derives the greatest income, greater than any other in the State of Massachusetts. We have one with us who is not only a theoretical but a practical man, and has been so all his life; one "who will speak what he knows, and testify to what he has seen." I introduce to you Professor Stockbridge, of the Agricultural College, who will now address you.

LECTURE BY PROFESSOR STOCKBRIDGE.

Mr. President, Gentlemen of the Board of Agriculture, Ladies and Gentlemen:—The subject of mowing and pasture lands, of the grass and hay crop, is one which has often received the consideration of the Board of Agriculture; it is one which has been discussed time and time again upon our farms, in our farmers' clubs, and by the agricultural public everywhere. And with you, gentlemen of the Board of Agriculture, it has not been merely a question of casual, random discussion, but it has received from you the most careful consideration, and has been with you a subject of practical experiment; and although it was said this forenoon that we knew nothing comparatively, yet all that we know upon this subject we have given freely to the world. We have published our proceedings, and they have been scattered abroad throughout our own Commonwealth, have gone to all the States of the Union, and to foreign lands; so that what we have said upon this subject is public property. In the first place, Mr. Flint, our Secretary, made a most exhaustive and thorough examination and study of this subject, and he published to the world a book under the title of "Grasses and Forage Plants," in which the whole subject is ably and fully treated. He was followed by Mr. Hyde, of Lee, who gave us a treatise on this subject, full of practical experience and good common-sense. He was followed by Mr. Johnson, of Framingham, who gave us the results of his experiments with pasture and mowing lands. Then we have had, from time to time, the opinions, theory and practice of such men as Loring, Lathrop, Anderson, Tidd, Stedman, and many others. Now, I say, all this experience, all this information, which has been gathered by the members of the Board of Agriculture, which has been thoroughly thought and studied out, we have been publishing to the world, and that has been going on through a long series of years, so that to-day it

is about time for us to inquire, What has been the influence of this teaching upon the practice of the farmers of the State? What is the present condition of the mowing-fields and pasture-lands of the Commonwealth? Has there been any improvement made under these teachings of the Board of Agriculture? These seem to me to be pertinent questions, as well as what we know to-day on the subject.

Now, gentlemen, it must be said first, that notwithstanding the thorough agitation of these questions, it has not had the effect to increase the hay-crop of Massachusetts, or the hay-crop of the country. We cured more hay in 1855 than in 1870. Although there was a slight decrease from 1865 to 1870, the crop of 1865 was many thousand tons less than the crop of 1855. Thus we have not increased the hay-crop of the nation by the discussion or study of this question. Again, if I am to judge by what I see is the prevailing practice of the farmers of Massachusetts as I go back and forth throughout the State, I am inevitably brought to this conclusion: that, comparatively speaking, the hay-crop of Massachusetts is of little value, and the reason is this: I find that they select their choicest and best lands and soils for other culture than that of grass. I find that while they take their sweetest, their warmest, their best soils to grow the grains and other crops, that any land is suitable for hay, and therefore our hay-crop is grown upon the most worthless and miserable of our soils; cold, sour, wet soils, which would not be put to any other cultivation, are allowed to grow hay. And again, I am led to believe, by the prevailing practice of our farmers, that the quality of the hay-crop is of no value. If choice, sweet, nutritious grasses grow, and they can gather them, well; but if instead they gather briers, brambles, and coarse herbage, it is apparently equally well. And, therefore, judging from the practice of our farmers, the quality of hay is of little account.

I am led to believe, also, by this practice, that the hay-crop is not worthy of care and attention in its cultivation. I find any amount of pains taken to grow fine crops of corn, fine crops of wheat, oats and all the grains; I find great pains taken in the cultivation of the root-crops; but I find precious little pains taken generally in the cultivation of the hay-crop;

therefore I am inevitably led to the conclusion, that in the minds of the farmers of the State, the hay-crop is of little value.

I am led to believe another thing by this practice, which is this: that lands which grow grass can suffer an amount of injury, an amount of abuse, which in any other department of agriculture would be considered ruinous, and yet that the hay-crop will thrive under that kind of culture. And I find another thing: that there is absolutely no need of any attempt to bring our grass-fields into any better condition. If they are wet, it is well; let them remain wet; if they are cold and sterile, it is well; let them remain so. We have simply nothing to do but to harvest the crop which Providence causes to grow there. And where we find any attempts being made to improve the quality of the hay-crop, or to increase its quantity by the use of manures and fertilizers spread upon the land, I am led to the conclusion that the best way is to manure them in the fall, at the latest possible moment before winter shall freeze the manure in the yard; dump it upon the fields in heaps, and allow it to remain until the following May; or else the best way is to take the unfermented manure from under the stable-windows, and spread that early in the spring. If you are going to manure grass, that is the best way to do it, judging by the practice of our farmers.

Another thing. Judging by the practice of our farmers, it is not best to spread upon these grass-lands any other fertilizer but these yard-manures. Another thing: it is not best to guard against injury to the grass-crop by any tramping to which you may be inclined to expose it; therefore, after having mown your fields just as late in the fall as they show any signs of growth, and having run the mowing-machine or scythe just as close to the turf as you can make the machine or scythe run, then the best way is to turn your stock on and let them tramp, tramp, tramp; whether there is anything growing on the field or not makes no difference; it is a good place to put the animals, and let them run, without any idea that the roots of the grass, in the frozen condition of the soil, can be injured by any amount of tramping. Therefore, I say, that judging by the prevailing practice, as I see it in the State,

and throughout the country, that is the best way to manage mowing-lands.

The management of our pasture-fields seems to correspond with the treatment of our mowing-lands. I judge that the best sort of pasture here in New England is that which produces the most brush, the most brakes, the most brambles, and the most briers. That is the kind of pasture-land which the prevailing practice of our people shows is the best. I find very little effort being made anywhere to improve the quality of the grass in our pastures. If they produce sedges, rushes and coarse herbage, that is all well; it is no advantage whatever to improve the quality of the grass by introducing those sweet, nutritious grasses which some men imagine are the only plants that will produce good milk or good butter. And there should be no effort made to put upon the pastures anything which the pasturing has taken off; simply leave them to nature, and then turn on all the stock you can get, overstock, stock down to the starvation point, and let your cattle run there just as late in the season as they can live. This, judging from the prevailing practice, is the best way to treat your pasture-lands.

Now, in contradistinction to this, I have looked the record through to see what the Massachusetts Board of Agriculture have said upon these different topics. I have looked Mr. Flint's "Grasses" through to see what he had to say on the subject, and to see if this is what we have been telling the farmers of Massachusetts for the last twenty-five years; and I find that we have said to each other and to the world, that the hay-crop is the most valuable of any single crop cultivated in the United States; that the hay and grass crop combined is worth, in the aggregate, in the United States, somewhere between five and six hundred millions of dollars. This is its money value. And, more than all that, we have said to the farmers of the country, that its value in dollars and cents is as nothing compared with its indirect value in the influence it has in preserving the fertility of our farms, as being the great source of manurial supply. We have said that no farm can be kept up to a high state of fertility; no farm can do otherwise than depreciate, if in its ordinary management we sell the hay produced upon it; and that no man can thrive on a farm, no man

can grow rich, no man's farm is supporting itself or him where the grass-crop is depreciating. That is the way the Board of Agriculture have talked in relation to the value of the grass and hay crops.

We have said, again, that so great is the value of the hay-crop of the country, that we can afford to select our choicest, our sweetest, our most fertile soils for the production of grass and of hay. We have frequently attempted to describe the character of the soil best adapted to the production of grass, and here, I must say, the Board of Agriculture are somewhat at loggerheads. One says a good grass-soil is a good corn-soil; another says a good grass-soil is a cold, and wet or moist soil. This is the only point about which we disagree; but we are all agreed in saying that the best soils, the most fertile soils, we can afford to devote to the production of this crop. And again, following the record, I find we have said this: that we can afford not only to take our best soils, but we can afford to bring those best soils up to the very highest point of fertility, and keep them in grass, keep them rich, keep them fertile, for the express purpose of producing hay. We have said again, that we can not only afford to do this, but we can afford to do it by the use of the best manures; that we can afford to procure fertilizers to make up for the waste which is continually taking place in the deportation of hay from the fields, and then we can afford to use compost manure,—mark the word! The Board of Agriculture have said we can afford, and must use, year by year,—not every year, but year by year as occasion may require,—complete top-dressings of first-class compost; that this compost should always be applied in the fall of the year, and that the earlier we apply it in the fall the better for the crops; and for several reasons as the Board have claimed. In the first place, because it nourishes the grass at that season, gives it a healthy and vigorous growth in the fall, makes it strong to endure the frost of winter, and seems to fit and prepare it for a more vigorous and perfect growth in the spring of the year. In the second place, it acts as a mulch for the young grass, and thus serves to protect it from injury by the winter's frost.

We have said, again, that there is such a thing as being too avaricious in regard to the crops which grow upon our mow-

ing fields; that there is such a thing as mowing our lands too close. And we reason it in this way: that there is a mutual relation existing between the roots and leaves of the plants; they grow in conjunction; the roots have their office to perform, the leaves have theirs; and when you denude a plant of its leaves, you have stopped this root-action; you have given it a check and injury from which it must suffer until new leaves are developed to carry on the functions of the plant. Now, then, we say, if we mow our grass-fields too close (and some variety of grasses will bear closer cropping than others), the point being, if we mow them so as to take all their leaves off, we have done a great injury to the plant, which we shall feel in the crop of the succeeding year; and therefore, according to the character of the grasses on our fields, we should mow them anywhere from two to five inches in height, rather than try to get down so as to get the last joint, as farmers say.

We have said again, that it is bad policy to mow our lands late in the season. While we think rowen is a good crop, and it is well to have it in our barns; while we do not object to the cutting of a second crop; yet under no circumstances should this second crop be cut late in the season, but it should be cut so early that there will be time for another crop to grow, to act as a covering for the plant, a sort of protection for it through the winter. This we have said.

Again, we have said that lands designed for permanent mowing, on the farm, once seeded down, once brought into good condition, should remain without ever being touched by the plough through all coming time. It is not good policy, we have said, to plough and re-seed lands that are to be kept in grass. We have said that, under certain circumstances, when we seed down lands, we should sow a great variety of seed, the ordinary practice being to sow but two kinds of grass-seed,—clover and herdsgrass,—and that it is better to put in not only these, but two kinds of clover,—the white and the red,—and a certain quantity, perhaps, of the Alsike, and some others. It is better to put in orchard-grass and blue-grass when we seed down, rather than sow only one or two kinds of seed.

Now, in regard to our pasture-lands. The Board of Agri-

culture have agreed unanimously to this: that there has been a great deterioration in the producing power of our pastures during the last fifty or one hundred years; that the time was when the hillsides of Massachusetts, those fields that are now our pasture-lands, yielded large quantities of sweet, nutritious grasses,—grasses which made butter, which made milk, which made cheese,—grasses which made beef of splendid quality. But, gentlemen, you may rest assured that the Board of Agriculture are right when they tell you that you cannot make either good milk, good butter, good beef, or good cheese, out of these brambles and briers that are so frequently found on our pasture, and that the richness and value of these lands depend very largely upon the fact that they produce fine, sweet, nutritious grasses, as they did in those early days, in large quantities; but they have gradually deteriorated. And to this opinion we gave our unanimous assent. They will not carry the stock of former years; the quality of the grasses is not so good, and they will not produce so good cattle, or butter, or milk.

Another thing. We have all agreed on saying that the cause of this deterioration is perfectly clear and apparent; that it is because we have been building up animal structures, or manufacturing cattle products which have been taken away from the fields that produced them, never to return; that where all the products have not been transported to the market, we have taken the milk for the manufacture of butter and cheese, and the manurial qualities that were contained in the milk left at home, have been given to other fields instead of being carried back to the pastures that produced them; and that we have been sending away tens of hundreds of tons annually from these New England pastures, in the form of phosphates and sulphates in the bones of animals, and nitrogen in their muscles and tissues; it has gone in one sweeping current down to our great cities; and then, owing to the most abominable and wasteful system of sewerage which has been adopted, it has been carried to the sea and been lost. We have agreed that this is the cause of the deterioration of our pastures.

Again, gentlemen, we have said to the world that from one-third to one-fourth of all these pasture-lands should never

have been deprived of their original forest-covering, and this I believe is gospel truth. The Lord never designed these steep side-hills, these mountain-tops for pastures; never designed them for cultivation; the topography of the country forbids. We cannot keep the soil in its place, in pasture or cultivation. It was designed, and it is best, that this portion of our pasture-lands, our mountain-tops and steep hillsides and declivities, should be allowed,—to use that expression,—to go back again to forests; and I would say, should not only be allowed, but should be assisted by systematic effort to go back again to forest. The effect of this growth of forests would be, first, to act as a shelter to our cultivated fields, to make our climate more equable, and to give us a more equal distribution of rain instead of having alternate seasons of floods and droughts. The land which we should then have under cultivation would yield more, under the influence of our forests upon them, than the whole yields to-day. Then we are agreed that, in relation to about one-half of the remainder, we should put back upon them that which we have carried away. As was said to-day, there is the real secret of success in agriculture. The cause of the deterioration of these fields is just as clear as sunlight; and although it is said we do not know much, yet I have faith to believe that we do know this, and that there is no mistake about it. We know that if we would ever see these finer grasses grow again upon these fields, we must put back upon them just that which we have taken away, and we know that if we return these elements, the nice, nutritious grasses will grow in great abundance. And we are of the opinion that they must be put back in kind. We have robbed these field of tons and hundreds of tons of phosphoric acid and lime in the form of bone; we have robbed them of nitrogen in the form of muscle. We must put nitrogen back in some form; we must put phosphate of lime back in some form; we must put potash back in some form. Then, we say, that about one-half of the remainder of these fields, which are rocky, where we cannot run the plough, which cannot be cultivated, must be restored to their pristine condition by top-dressing.

Now, gentlemen, do not be alarmed and say that we cannot afford to do it. I tell you we can afford to do anything rather

than go to destruction. We *must* do it, and I believe that we have got Yankee wit enough to contrive a way of doing a thing that we find must be done. I say that this Board of Agriculture has declared that about one-half of this land which remains, after the other portion has been allowed to go back to forests, should be reclaimed by top-dressing; the other half, we are of opinion, should be renovated by cultivation and by applications made in the form of manure. Where we can run the plough, the fields should be taken up, should be thoroughly tilled, fertilized, cultivated and receive all the benefits of fertilization and tillage, and then re-seeded. This I believe to be the opinion of the Board of Agriculture in relation to the management of our pastures.

Now, gentlemen, I have but little of my own to say. In the first place, I most heartily, in my own individual view, coincide with these views of the Board. I believe them to be the gospel in relation to the grass-crop, the hay-crop and the management of these pastures and mowing-lands. The whole field has been surveyed, and while I give my full assent to the views of the Board thus far, I have a few additional suggestions to make.

In the first place, in relation to the value of the grass and hay-crop. We take our estimates from the statistics of the governments of the States and of the United States. When they gather these statistics, they say, for instance, that the hay-crop alone is worth somewhere about four hundred millions of dollars.

Now remember that this is a commercial valuation; but you know full well that the hay-crop of the United States is not a commercial product. Although we sell more or less hay, yet by far the larger portion of the crop of the whole country is consumed at home, on the farms where it is produced, and the money value of the hay received by the farmer is received by him from stock and stock products. The farmers of this country never received anything like four hundred millions, or three hundred and fifty millions of dollars from the hay-crop, in money. They received it in a different form. But I want to call the attention of the farmers of Barre and of Worcester County to the hay-crop, considered merely as a money crop. We have in Massachusetts to-day about one hundred thousand

animals that are not kept upon our farms,—forty-five thousand horses, and fifty thousand oxen and cows,—that are in towns and villages, and not upon the farms. They feed upon hay brought from somewhere, and must consume annually more than two hundred thousand tons. Between four and five millions of dollars annually are paid by Massachusetts men for hay, and this money goes somewhere. Here is a demand which should make hay in Massachusetts a commercial product. We want not simply to sustain our farms and keep up their fertility, but we want to have the Yankee wit and ingenuity to avail ourselves of the advantages which we possess in Massachusetts, owing to the density of our population and the wants which our civilization brings; and, if possible, we want to retain here in Massachusetts, and save to our farmers the four or five millions which are being annually paid out by our citizens for the hay-crop produced by somebody. Now I don't want you to say that we cannot afford to raise hay and sell it; that if we do we cannot keep our farms up. As well say that the farmer in Vermont cannot afford to sell his hay for twelve dollars a ton, which the man in Massachusetts, who must buy hay, must pay thirty-five dollars for. The farmer in Vermont or Central New York gets about twelve dollars a ton for his hay. The man in Worcester, who is feeding horses, pays thirty-five dollars for it. Who has the difference between the twelve dollars and the thirty-five dollars? Now if the farmer in New York or in Vermont or in Maine can afford to sell his hay for twelve dollars a ton, can't you get up Yankee wit enough, when the place of consumption is within two hours' drive of the farm, to support your farms and sell your hay where you can get thirty-five dollars a ton for it, and make money enough by the operation to enable you to keep up the fertility of your farms so that they will produce hay? I am after that five millions of dollars! I do not want it to go to New York, where our friend Lewis comes from, nor to Vermont or New Hampshire. I want the farmers of Massachusetts to contrive some way to keep their farms up, and yet keep that money at home. I tell you, I do not believe but what we can do it. In the first place, all those men can do it who are so situated that they can carry their hay to market and return the produce of that

hay in the form of manure to their land. Although I am not able to agree with our friend who spoke this morning, who told us that fertilizers which will sell for fifty dollars a ton, will pay better to buy than to take barn-yard manure for a gift,—I am a great ways the other side of that,—yet I believe that we can contrive, by the judicious purchase of manurial agents that have never been through any manufacturer's hands, like sulphate of lime, sulphate of ammonia and all that class of manurial agents that everybody knows of, which there is no discovery about, and nothing "dear-bought and far-fetched" about,—I say, I believe we can make a compost of these fertilizers, and contrive in that way to keep up the condition of our fields, and at the same time sell a portion of our hay and get the money which is now being sent out of the State. Let us try it. You who are near this great hay-market, where you can get from thirty-five dollars to forty dollars for hay, seize the opportunity! See if you cannot afford to try the experiment! I am perfectly satisfied you can make money by the operation and not depreciate the value of your farms.

I have another thought. I find by examining the statistics, that we consume in Massachusetts to-day the products of five hundred thousand more cattle than we have in the State. Our population is dense, I grant; we have our large manufacturing towns; but really, the consumption of cattle products in the form of beef, butter, cheese and milk is enormous; and if we had five hundred thousand more cattle in the State to-day than we have, we should consume all their products. We have got the idea, and it goes from mouth to mouth, "that our population has become so dense, our soils are so run out, and we are all so sort of fagged-out that we can't compete with the West; the West has got to supply us with cattle. New England cannot afford to grow stock." Oh, no! We may possibly afford to raise dairy animals; we can make some milk for the Boston market, and the markets of our large towns; we can perhaps afford to make some butter, like Mr. Ellsworth here, and send it to Boston where we can get fifty cents a pound for it; but really we can't raise cattle here in Massachusetts; "the day for that has gone by;" our population is too dense; we have not land enough, and we must

look for our cattle-supply to Texas, to the plains of Colorado, Nevada or somewhere beyond the mountains and beyond the great rivers." I wonder if we thought during the war, when the Rebels held the Mississippi, that we had got to go to Texas and the great plains of the West for our supply of cattle! I wonder if our soil is so exhausted to-day that we are obliged to draw all our breadstuffs from the West, whether we shall be able to support the population we have in our territory! Is it not best for the farmers of Massachusetts to strive to be a little more independent and produce their own food? Let us compare our condition with that of Holland, Belgium, France and Old England itself. Do you ever hear them talk in France, Belgium or Holland about their population being so dense that they cannot grow cattle! Why, they have there ten head of neat stock to their inhabitants where we have one.

We hear no complaint from Holland that they cannot grow animals, or cannot supply themselves with beef. Belgium and Holland, although their population is much more dense than that of Massachusetts, are able to produce immense herds of cattle and send them to England and everywhere else where there is a cattle-market. Cannot Massachusetts do something of this kind? Are our hills so sterile, is our territory so small in proportion to our population, that we cannot give up any portion of it to the growing of cattle? I tell you I wish to do something to stop this talk which we hear on all sides, "We cannot do this and we cannot do that." I believe in my inmost soul that if we would go to work at the foundation of this thing, we could double the stock of Massachusetts and support it on the territory we possess. We could double our cattle-products, and we should be better and richer for it; and I know that, under certain circumstances that might arise, we shall be a great deal more independent. Let us strive then, using the wit which God has given us, and the intelligence which we are daily acquiring, to increase the number of cattle upon our territory.

Again: I do not want to be heretical here, but I desire to express a few thoughts in relation to the treatment of our grass-lands. The Board of Agriculture have said, "Never plough the fields that you intend for permanent mowing.

Once seeded down, let them remain seeded forever." In relation to that, I beg leave to differ, and I will give you my reasons. Let us have as many minds at work upon this subject as possible. Perhaps we are mistaken. I do not believe that the Board of Agriculture, or any one of us, know it all. I think we have a great deal to learn, but I think there are some things we do know. Now, in relation to the ploughing of grass-lands: Do you believe there is anything in tillage? Does it do the soil any good to plough it, to pulverize it, to break it up and expose it to the air? Does it help your fields upon which you grow corn to plough them, to pulverize them, to till them thoroughly? If it does, why will it not help your grass-field to treat its soil thus, especially if that grass-field shall have for its soil a clay? Will it not do that soil good to let the air into it, to warm it, and set the chemical forces at work to develop the plant-food it contains? If there is any truth in the theory of the value of fertilization and tillage, can we not apply it to the grass-crop, and thus reap the advantage? The objection you urge is this: "When we plough up our grass-fields, our mowing-lots,—where we grow the fine grass which will make our cattle sleek, and make such milk as the grass from these mowing-lands will make,—when we plough them up, seed them down, we put in artificial grasses, herdsgrass and clover, and these will not make such good milk as the natural grasses, and we find there are a great many vacant spaces not filled with plants;" therefore the Board of Agriculture has said: "It is not best to plough them up, for the grass is not so good, and it takes a long time to get that full and close covering of herbage which would be there, provided it was not ploughed." Now, if there is anything in the principles of tillage and cultivation, if it does the soil good to pulverize it, then these fields ought to be ploughed occasionally, especially those which have clay in them. The constant tramping upon these fields to gather the hay, and the attraction of gravitation and cohesion greatly solidify them, especially clay soil, and they become hard, and notwithstanding your top-dressing, by and by your hay-field actually begins to fail, and on goes a greater quantity of manure, because you dislike to plough it up. Now, my experience and observation are, that there is no grass-land in

Massachusetts but what ought to be ploughed once in ten years, sometimes as often as once in five years. The length of time which a field should be allowed to remain in grass without being ploughed up and pulverized depends on the condition of the soil.

I know this is heresy; but I am going to give my reasons, and then you may have your chance at me. I will tell you what the trouble, in my judgment, is: When we turn over our hay-fields and re-seed them with two kinds of grass,—herdsgrass and clover, and perhaps a little redtop,—it takes a long time to get them back into a fine condition. I have tried it, and I found that apparently I had met with a great loss by ploughing; but when I seeded with a variety of seeds, when I put in herdsgrass and clover and redtop and white-clover; when I put in orchard-grass and Kentucky bluegrass, and a large variety of grasses, in two years I had a covering as close as I had before, and the crop went right along upon the land increasing every year. The reason why, apparently, it did not benefit my land to plough it and pulverize it and work it all to pieces was, that I did not do right when I seeded down with simply two kinds of grass, herdsgrass and and clover; but I got a quarter more grass upon the land in ten years by ploughing twice and re-seeding, without top-dressing, than I got with the best top-dressing without ploughing. Therefore I say, according to my observation, and I think I have very good reason for it, that our grass-lands should be occasionally ploughed up, pulverized, thoroughly tilled and re-seeded.

Now, if you will pardon me, I will occupy a moment or two upon the question of the selection of soil for grass. I think Mr. Hyde said that the best soil for grass was the soil for corn. Another eminent writer has said the best soil for grass is a clayey or moist soil; that it is the more natural soil for grass. It seems to me that the grasses are adapted to a cool soil, if you understand what I mean by a cool soil. Corn and grass (although corn is a grass, belongs to the family of grasses), differ in their nature and in their origin. I speak now of the finer and better grasses. Corn is a plant of tropical or semi-tropical origin. It luxuriates in a warm, hot soil. You must have a warm soil, either natural, or made so artificially by man-

ures, to get a crop of Indian corn. On the other hand, grass is a native of the temperate climes. It requires a colder clime, a colder atmosphere, a more moist soil than corn. Therefore, grass and corn have not a special adaptation for the same kind of soil; corn wants its warm soil, grass wants its cold soil. But grass abhors stagnant water. When I say that grass wants a moist soil, I do not mean that it wants a soil which has water standing in it stagnant, on account of there being a hard-pan strata below, or which has in it spring-water which must seek its outlet, not down through the soil, but on the surface of the soil. That is not the soil for grass. When I say that we want a cool, moist soil, I mean one which is moist and cool not in consequence of a water-bearing strata below, which keeps the water stagnant there, or because there is water flowing upon it from higher land, but land which is moist and cool in consequence of its retaining and absorbing power. That is what I mean by a cool, moist soil, which is adapted to grass,—a soil which is perfectly dry, so far as stagnant water, or water coming upon it from higher lands is concerned,—but which is moist and cool because it has in it either a slight amount of clay or a given amount of carbonaceous matter, so that it absorbs from the atmosphere and retains a certain amount of rain-water when it falls upon it; that is precisely the soil for grass.

Now, I have another remark to make in relation to our mowing-fields,—and this will apply to Massachusetts in relation to the growing of grass as a market-crop to catch that five millions of dollars which is going out of the State annually for hay,—and it is this: that we must resort to irrigation. That is nothing new; everybody knows all about that. I tell you, gentlemen, it is not because we do not know enough, it is because we do not practise what we know; that is what ails us here in Massachusetts. We know considerable, but we do not practise half as well as we know how; but we are going to be driven by necessity and cupidity to avail ourselves of the immense advantages to be gained in the production of grass by irrigation. Why, I have heard within the last two years a Massachusetts man, an intelligent man, speak of the splendid chances for agriculture in Colorado. What are they? They have limitless fields of sage-brush and saline plants, but upon

which nothing will grow that could nourish man or beast; yet it was said that it was a splendid field for agriculture. Why? Because you can go out there and take one of those mountain-streams and conduct it down and irrigate that land, and make it produce something. Yet, we had never thought we could use irrigation in Massachusetts. If it will do such wonderful things for Colorado, may it not do something for the farms in Massachusetts? There is no question about it. It is not a new thing. Italy has practised it for generations; France has practised it; Germany has practised it; and over very large tracts of territory both in France and Germany, the testimony to-day is that their crops have been more than doubled simply by irrigation. Is it not possible for the farmers of Massachusetts to use this power to fertilize their grass-fields? Why, bless you! I thought this was a land of brooks, and rivers, and streams of water that were running down our hillsides. I know we have seasons of drought, and seasons of flood, but I tell you we have water enough in Massachusetts to make more grass than can be used in the production of hay. Simply water put on these acres would produce the best crop of grass, without any other fertilizer.

Now, a few words in relation to this matter practically. I have seen fields in Massachusetts mow two crops, year after year, year after year, with no other fertilizing element given them than water, and if one man can do it who has the facilities, others can do it who have equal facilities. There are a great many things which need to be understood in connection with the application of water. In the first place, the finer and better qualities of grass flourish under the influence of water if it is rightly applied and used; therefore, if we would have the fullest advantage of irrigation, we must resort to underdraining; and then we have this very great gain, the water being received upon the soil, is carried down through it, and all its fertilizing elements are left behind. This is without expense other than tapping some mountain-stream. I may spread that water over acres of grass and mowing land, and thus make them bear their two crops year after year, and sell that grass from the farm and receive a portion of that money which I want to keep in the State, because water is cheap and plenty. Can we not do it? It seems to me that we can. At any rate, it is one of those things that ought to be tried.

Gentlemen of the Board, I make these suggestions in relation to our hay-crop, knowing very well that there is a diversity of opinion in this matter. If they meet your views I shall be pleased; if not, I hope you will take them up and shake them out.

In relation to our pastures I fully agree in regard to this matter with the Board of Agriculture on almost all points. I would apply to our pasture-lands precisely what I would apply to our mowing-fields. I believe that we cannot afford any longer to use these pastures in the condition in which they now are. I do not believe we can afford to buy stock or raise stock and attempt to grow milk and then feed them on brakes, brambles and herbage of that kind; that thing is "played out;" and if we are going to try to supply our own home markets with butter, with cheese and with milk, the first step to be taken in order to supply these elements is to improve our pasture-lands, improve the qualities of the soils, and increase the quantity of the grasses they produce. In relation to this matter my opinion coincides almost exactly with the opinions of the Board of Agriculture in relation to the methods of their improvement; but some things may be said in detail in reference to how it shall be done. I do sincerely pity that man who has a hundred acres of pasture-land, one-half of the surface of which is nothing but rock, and half of the remainder is covered with brush. He is to be pitied. I know the trouble and annoyance of being everlastingly, through two months of the year, mowing bushes and clearing our pastures, but that has got to be done. It is no use to talk about making fine, sweet nutritious grasses grow where the land is half covered with bushes. We have got to get rid of these bushes somehow. Now there are various ways to do it, some of which have been recommended by our good friend, the Secretary. I do not know whether it is in his book or not. If it is not, it should be, and I will put it there now. One way to get rid of these bushes on pastures which cannot be ploughed, is by pasturing them with certain kinds of stock. I approve of what the Board of Agriculture has said in relation to retaining the fertilizing elements which have been carried away; but I would try to kill two birds with one stone. While I was trying to get something from my pasture

to make it pay its way, I would try to turn it to something to make it pay its way. One recommendation is that sheep be put upon your pastures. They are death to certain classes of bushes. They will kill, there is no mistake about it, the brambles and briers which infest our pastures. Now sheep, either in consequence of dogs, or something else, have been almost all driven out of the State. I believe we can do a good thing for ourselves simply in the direction of raising early lambs for market, while at the same time we put upon our fields flocks of sheep which shall act as a scourge upon bushes. Now Mr. Flint tells us that sheep put upon a pasture of the right kind, where the bushes are plenty, and overstocked (that may seem strange to you) for a year, will be compelled to live upon this coarse herbage, and they will gnaw it so close that they will kill it. You, in the discharge of your duty to your flock, will feed them with cotton-seed meal to keep up the nutrition which they will not get from the bushes, and you improve your flock of sheep while improving your pasture, and at the same time you will get from the flock enough to pay you for all the money you have expended; your land will have a more valuable kind of grass, and the value of the lot afterwards will be largely increased.

That is one method. There is another: kill these bushes out by mowing. There is such a thing as "diligence and perseverance overcoming all difficulties"; and while it is rather a disheartening operation to attempt to subdue our pastures by mowing, I tell you it can be done; that if a man persistently sets to work to rid his pastures of these pests, he can accomplish it in one or two ways. In the first place, if the pasture is all overrun with bushes; if they are high and large, he can give it up to forest and let the trees grow. Then he should cut this growth of bushes all down thoroughly and completely, and the best way of doing it that I ever saw was to take a yoke of cattle, a good chain, a good axe, a stub-hoe, and put the chain around a clump of the bushes and tear them out by the roots; or else take a scythe and cut them off, and cut them so persistently that they shall die. But having taken them out and piled them up in heaps and burned them, don't stop right there, for pity's sake. I have seen many pastures where the owners stopped just at that point, and the result was that

everything fine, succulent and nutritious was killed by the fire, and the bushes that had more vitality, sprang up and grew, and grew the stronger because the farmer stopped just there. But having burned your bushes, then with a drag, if it can be used,—if not, with a hoe,—see that that land is seeded with a variety of grass-seeds, dug in or raked in. They will come up, grow stronger and stronger, and take possession of the soil. If any bushes show themselves afterwards, it is one of the simplest things in the world to pull them up. Thus you can clear your pastures of bushes almost without expense, because you can do it when the help on the farm is not otherwise engaged, and the result will be in time what you desire; your land will be covered with fine, nutritious grass.

These are all the thoughts which occur to my mind. What are you going to do about it? That seems to be the important question. That is the whole story,—what will the farmers of Massachusetts do about it? We know enough to-day, gentlemen, although we do not know but little, yet we know enough to-day to make our fields more fertile, and to make them bear better crops, and more in the aggregate than they bear now. There are some men in the community who are great friends of the Agricultural College and agricultural education, who are great friends of science, and who seem to be standing with their hands in their pockets waiting for science to work out the miracle to which President Clark alluded this forenoon in relation to the renovation of the sterile soils of Massachusetts. They really expect that science is going to work wonders for us, and they are waiting for that good day of the millennium to come when they can simply sit in their homes, and by shaking the wand of science over their farms, they shall bear the best of crops and in the greatest quantity. I see such men occasionally, and they are glorious fellows for the Agricultural College, speak highly of the education there, and expect that really this wonderful thing is to be accomplished. Now, gentlemen, they are bound to be disappointed; that thing is never to be done. Science will never point out a royal road, so that you can reap all these glorious advantages while you sit in idleness; that you may depend upon. After some little examination of this subject, I have come to this conclusion, that science is good for nothing for a man who

folds his hands and sits idly by to see science work. Nothing whatever will be accomplished by it. While I believe fully in science, and in the advantages which education can bring to agriculture, I tell you, gentlemen, that the only service (and that is inestimable) that science will ever render to agriculture, is that it will direct agricultural labor aright. It will give efficiency and power to every blow struck in agriculture, because it will be struck with an intelligent purpose. It will teach us what needs to be done and the means by which to accomplish that very thing. But we have got to do the work, after all, and when we are ready to take hold, gentlemen, it seems to me that, guided by what we already know, and ever looking out for new light to be obtained from every source, there can be no question but that, if we apply our attention to it, we can make two blades of grass grow where one grew before, and we can add hundreds of millions of dollars to the aggregate value of the agricultural products of the United States.

The CHAIRMAN. In the address to which we have just listened two things are brought very prominently before our minds. The first is, that we should gather all the knowledge possible; and, secondly, that we should practise what we know. There are many topics appertaining to this question of mowing and pasture-lands to be discussed, and I hope you will all be free in the interchange of your opinions upon this subject. The question is now open for general discussion by the members of the Board and any one present who has a word to say upon the question.

Mr. ALLIS, of Conway. This subject is one that interests me more particularly than any other that has come before this meeting, and for the reason, perhaps, that reclaiming lands by underdraining has been a specialty with me, in order to produce, from lands which were almost valueless, great crops of grass. You will please to remember that when any man gets up in an assembly like this and makes a statement of his experience, you are to take into account that it is his experience in the particular locality in which he resides, and although this may not agree with the experience of other men in different parts of the State, you will understand that I am speaking for the vicinity of Franklin County, or Western Massachusetts.

This subject is interwoven with a variety of considerations. The increased receipts for fertilizers, as well as thorough cultivation that can be attained, are truly wonderful. What I have to say is the result of the practical workings of a system of underdraining, carried on for more than thirty years, although much more largely for the last twelve years; not by proxy, but with my own hands and hired help to work with me, having laid nearly all of the drains myself, closely watching the tendency of the surplus water on the different slopes of land, and among the various strata of soil so prevalent in Franklin County and vicinity. Porous and gravelly soils, with no underlying strata of clay or hard-pan, are not superabundant in this locality, except in some portions of our river-bottoms. On the contrary, a very large proportion of our soil is a dark, strong loam, of from twelve to eighteen inches in depth, with an underlying hard-pan bottom of extreme solidity; a soil which, when freed from an excess of water, and well cultivated, becomes very productive and valuable.

There is comparatively but a small area of our lands lying in low swamps or muck-beds, the receipts of the washings of our hills for ages, the draining of which I do not propose to consider at this time further than to make them accessible as our depositories to draw from in the increase of our composts, and then return them to their more elevated nativity, and those I would leave in open drains. It is to the more elevated portions of our table-land, meadows and slopes of various degrees, which so largely preponderate in Western Massachusetts, that I would speak of now; such lands, too, as some claim unquestionable authority in declaring that they do not need draining or will not pay to underdrain. A large proportion of our soil is of a loamy, spongy nature, resting upon an unfathomable stratum of tenacious hard-pan, assisting their retentive powers in time of surplus water, to the detriment, if not the destruction of crops. Our slopes abound in springs, constantly diverging in every direction to the detriment of cultivation and quality of grazing. The best, and perhaps sole effectual remedy is underdraining.

In my experience of the laying of nearly three miles of underdrain I have tried, first, to ascertain the various sources from which the excess of water proceeds, whether from

springs on adjoining lands, or stagnant water. Having become acquainted with the fountains thereabouts, observation and reason in connection with the surface or slope of the land will readily suggest the course, depth and number of drains necessary to accomplish the desired object. Writers tell us that drains should be run up and down slopes once in thirty or forty feet, in order to drain effectually. My experience is against that. It naturally is and must be the question with common farmers, How far can I go, how much money can I spend in any scheme of improvement and make it pay, as we cannot afford capital, labor or time without a full equivalent? Hence the necessity of studying rigid economy in reclaiming land by draining, in going just so far as will pay a good per cent. profit for the investment, considering the benefit that will accrue to the several crops that may hereafter be raised thereon, the increased value of the land, and advantage from the various fertilizing agents applied. I have found in draining different plots of land from two to four acres each, on a slope of from one to five degrees, that they can be sufficiently drained for cultivation with about one-half of the length of drain proposed by some, if judiciously laid out and thoroughly laid down.

For instance, in draining a piece of land twenty-four rods square on a slope of from two to four degrees, with parallel drains running up and down the slope, once in forty feet would necessitate ten drains of twenty-four rods each,—two hundred and forty. I have drained such a piece of land for the successful cultivation of all kinds of crops, tobacco not excepted, with half the above number of rods, by running two main drains up and down the slope equidistant, with three branch drains upon each side, six rods each, with angles a little acute up the slope, making in all one hundred and twenty rods; the drains being placed from four to six rods apart, upon the upper portion, which so successfully drains that portion that there is nothing needed below, unless there is some living spring. Said drains were dug three feet deep, a depth which will receive the superabundance of water at the top of the hard-pan very rapidly, leaving the soil in a suitable state for cultivation very quickly; the drain was dug by ploughing a narrow double-furrow, pitching the turf into

heaps to cart into the yard, then shovelling the soil, following with pickaxe and shovel, several times over, till the depth of three feet is excavated from ten to twelve inches wide, which is as narrow as a person can work in to advantage with a pick and shovel in blue hard-pan. This gives about a foot and a half of drain below the soil, and mostly below the frost, and will take in the surplus-water almost as quickly as the soil receives it, if laid with stone, and I have used no other material, having been able by frequent ploughing and using a few piles on my neighbors' lands in close proximity, to obtain all I needed from year to year. But it was declared before the Board of Agriculture last year that stone drains were a failure; also that tile drains were the cheapest, if you could have the stone delivered. That was not accepted in my vicinity, for the following reasons: First, the failure. I have sixty rods of stone drain under a two-acre plot, of not over one degree slope, laid thirty-five years ago, in as good running order now as ever, for aught I know, and have laid none since that has proved the contrary. In laying drains, I place the flattened surface of the larger stones lengthwise of the drain, with the sharpest point down, side by side, until from six to ten inches from the bottom. I have them packed very firmly between the hard-pan sides, then filling on top with smaller stones, nearly to the top of the hard-pan, making it very compact on top, firm in the centre, with several fine aqueducts at the bottom for free and abundant flow of water; cover the stone with fine hemlock-brush, swamp-grass or litter, though I prefer brush, which will last until the dirt over it is thoroughly settled; cover with dirt and stamp down till fully rounded, fitting, according to my observation, for the draining of land much more rapidly than tile-drain, to the special benefit of growing crops.

The comparative expense is decidedly in favor of stone with me. The digging and laying of drains has cost me from sixty to seventy cents per rod. The stone I pick and cast off every time I plough, and it is usually more convenient to dump them beside the ditch than to draw off to the side of the road, or any other conspicuous locality, to form brier-hedges, while the cost, transportation, digging for and laying of tile would cost nearly or quite one dollar per rod in my vicinity; not-

withstanding, if I could get no stone, I should use tile to some extent as the next best thing, and if laid in gravelly or any porous underlying strata, I should use tile of course. But does it pay to underdrain such elevated, hard-pan bottom-lands? I answer, Yes; to the realization of greater receipts than in almost any other variety of circumstances. It renovates and enlivens our loamy or clayey soils so that they will receive heat and air with a greater readiness, which prepares them for the growing of grass or other cultivated crops much more vigorously and of a better quality. To what an extent lands may be improved and what results may be derived from draining and good cultivation, I offer you the following as an illustration:—

I came in possession of a four-acre piece of pasturage in front of my house some ten years ago, worth from five to twenty dollars per acre, the preponderating product being a wet, poor quality of pasturage, interspersed with a generous supply of bog-brake, knolls and some bowlders. In the fall of 1862 I commenced labor upon it by getting out the rocks, laying one hundred and twenty rods of underdrain, broke it up, employing the third man to follow the plough with a hook to turn over what sods and brake-knolls the plough did not. In the spring of 1863 I harrowed well the turf, planted corn, putting a little phosphate in the hill, cultivating with a purpose mainly to subdue the land, and harvested twenty bushels of corn per acre. In 1864 the market-value of manure applied, delivered on the land, was four hundred dollars; I bought a part of it; phosphate put into the hill, fifty dollars; about the first two weeks in June, it was set with tobacco; fitting ground, cultivating, harvesting and preparing for market, cost three hundred and fifty dollars; total expenses of crop, eight hundred dollars; I received for the crop one thousand eight hundred dollars. In 1865 I applied four hundred and fifty dollars' worth of manure and fifty dollars' worth of phosphate; stocked with tobacco; cultivating and fitting for market, three hundred and fifty dollars; total expense, eight hundred and fifty dollars; I received for crop, two thousand two hundred and forty dollars. After harvesting the second crop I raked together the brake-heads, which, notwithstanding being cuffed to skeletons, amounted to cartloads, and burned

them. In the spring of 1866 I sowed with oats and seeded down with one-half bushel of Timothy and five pounds of clover seed per acre; harvested two hundred and seventy bushels of oats; I have mowed two crops of grass yearly ever since, with the exception of one dry season, and consider the land worth at least one hundred dollars per acre in its rural locality.

Having offered this result of my experience as a sample of what may be realized by well underdraining and good cultivation, and believing there are large portions of land in Western Massachusetts that can be made to show as great, if not a greater margin of improvement, I am led to the conclusion that draining is the pioneer of the plough, the pulverizer, the mower and all other accompanying machinery, as well as the improvement in quality and quantity of our cereals and grasses. When our community become convinced of the intrinsic value of draining to cultivation, to the positive action and the proper application of fertilizing properties to our soil, they will have gained a long stride in an agricultural education. The plough should now take its position to pulverize and prepare the land for cultivation and for the variety of improved machinery to follow.

It may be said that I should not have received so much profit from any other crop. That may be true; but I will say in regard to the cultivation of tobacco, that I believe it has been a benefit to our community up and down the valley, because it has taught farmers to take every possible means to save all the manures that can be manufactured on their lands and farms. It has become the practice, very generally, among our farmers, within a year or two,—and it is increasing very rapidly,—to stable their cows the year round, even if they have but a small number, and to litter with sand or dirt, or some kind of absorbent, by which they save all the manurial properties of the droppings of their animals, and increase their manure-heaps wonderfully.

There is another reason why I think that the cultivation of tobacco has been an advantage. It has certainly improved the appearance of our lands very much indeed. Underdraining has been carried on there to a large extent, for the reason that it is impossible to get a good growth of tobacco where any water will stand at any time of the year. I know, there-

fore, that the raising of tobacco has been a blessing to that community in that re pect, if in no other way.

Mr. Root. In the most excellent address to which we have listened from Professor Stockbridge, we have been told how the production of hay has fallen off. If you knew how we in this section have suffered in the loss of our grass in consequence of the droughts of summer and the severity of winter, you would readily apprehend how the figures have fallen off in the statistics of the several States. I wish very much to hear some statements from gentlemen who have re-seeded their land, as to the course they have pursued. What is the most successful way of bringing into luxurious growth our grass-lands? We of Worcester West are intensely interested in this question, because it affects our pockets. We cannot live without our grass. I only rise to say that I hope this subject will be properly considered.

Mr. Goodman, of Lenox. I want to say one word, for two reasons, which will appear before I get through. I am very glad that our friend Stockbridge has had the boldness to "beard the lion in his den," and he laid down some doctrines of which I highly approve. Nothing interests me more than the improvement of our pastures, and I know that is a subject the importance of which will be felt in this district, because it is upon the hay-crop that the value of much of the land in this vicinity depends.

The farm I occupy is situated, as very many of the farms in this section are, on high land, and our farms are infested by a weed, or bush, which probably is not known here,—the hardhack. It takes possession of our best pastures; it runs over them rapidly, and is the great curse of the country. How to get rid of it is one of the most perplexing problems with which the farmer has to deal, and very few men have the courage to undertake it. I wish to mention one incident, merely to illustrate the character of a man who has just departed, and the great interest he took in everything appertaining to agriculture. I knew Mr. Greeley for many years; I have the highest respect for him as a man, and believe he has done much for the promotion of agriculture in this country. Some years ago, I prevailed on him to come to Lenox, for the purpose of delivering an agricultural address. After the

address, he went to my house to dinner, and when dinner was over, he said, "I want to go over your farm." I took him over the farm, and when we got back he said, "You have got a large farm, and I want to send you twenty or thirty Swedes and Germans to help on the farm." "But," said I, "I can't afford to pay them." Said he, "I noticed that you have thirty or forty acres of hardhack here, and that you want to get rid of." I said, "I have not yet been able to devise any means to get it out, without a great deal of expense." Said he, "I am going to the Constitutional Convention at Albany this winter, and I want to come over to your place, and when I come, I expect to see all those bushes cleared off." In a few months I got a line from him, stating that he was coming to see me. I had not touched the hardhack, but there was about an acre that could be seen from the fence near my house, and I set my men at work and had this place cleared. I did not find it such terribly hard work as I contemplated. One man took hold of a clump of the bushes and another cut the roots with a stub-hoe and then tore them out. When Mr. Greeley came I was very anxious he should see what had been done, and I took him out to the fence, and he was entirely satisfied. He assumed that the whole forty acres had been cleared, and said that was good farming. I kept at work upon them until the whole forty acres were cleared, and got rid of the last of them this summer. The bushes have all been torn up and burned. I am going further than that. I have got the hardhack ashes, which are the best manure in the world, and I am having them distributed over the land, and next spring I mean to take Professor Stockbridge's advice, and run my harrow over it and sow it with grass-seed. I had hoped, after Mr. Greeley had been defeated as a candidate for the Presidency (for I did not want to see him elected), to have had the pleasure of seeing him at my house, and show him, truthfully and faithfully, what had been done. I mention this, in the first place, to show that after a man once gets started in a good work, it is very easy to go ahead and carry it out; and this work of clearing pastures, either by feeding them off with sheep, or by cutting them off, when you once really set about it, becomes a pleasurable business. You can clear your pastures of this hardhack, and you have no idea

what a pleasurable feeling goes through the system when you see your cattle feeding on grass rather than on bushes. In the second place, I wished to pay a tribute to a man whose character has been so bitterly assailed in the heat of partisan warfare, but who was always faithful to the interests of agriculture. I do not suppose there is a man who has lived in this country who, for the last twenty-five years has done so much to promote the interests of farmers, through his personal example and his lectures and writings, as this man who has so recently deceased. We should forget his errors as a politician, and remember him hereafter as the great farmer of the country; a man who knew a great deal about farming, and who was specially devoted to the promotion of the interests of that class of the people who live by the labors of their hands in the fields.

President CLARK. In order to make a point in regard to my lecture last night, and in order that the farmers of Barre may properly appreciate the arduous labors of my friend (and he is a very industrious man when at home), I want to explain what hardhack is. I went to see him once, and observed a field covered with bushes. I opened my eyes at once, and said I, "Why do you have that field covered with brush?" Said he, "That is hardhack." I said, "That is not hardhack in our country." "Well," said he, "it is hardhack here." If he had told me the Latin name, which he knew as well as I did, I should have known what he was talking about; or if he should use the Latin name in England, or Germany, or Spain, or South America, he would be understood, for the Latin names of plants are the same in all countries, and almost all of the original descriptions of plants are written in Latin. This plant which he calls his hardhack is a plant which belongs to the same order (*Rosaceæ*) with our hardhack, but it is a much stronger plant, and much more difficult to eradicate. It grows in large clumps, three or four feet high, and is quite a formidable plant. Our hardhack, which can be pulled up by hand, is not a circumstance to it. Our hardhack is the *spiræa tomentosa*, and his hardhack is called the *potentilla fruticosa*.

Colonel STONE. I regret that the discussion on the cultivation of fruit has been cut off, owing to the absence of the

distinguished pomologist (Col. Wilder) who was expected to open the discussion. As yet, I understand there have been no attempts made in Barre to cultivate the smaller fruits which are so profitably grown in many parts of the State; but I am happy to know that the time will soon arrive when she will enjoy those advantages in the way of railroad transportation which other portions of the State enjoy, and it will then be an important subject to the people of this town. The cultivation of small fruits and vegetables will then be a profitable branch of agriculture. The opening of railroad communications will bring manufacturers here. You are to have a manufacturing village, and if you will look the country over, and more especially New England, you will find, wherever you find a manufacturing village, a healthful and thrifty farming-interest. I think I can look forward to but a few short months when all these great changes are to commence, and then I shall expect that the good old hills of Barre will smile with the beautiful fruits and vegetables which are raised in other parts of our State so successfully. Here is a gentleman, living forty miles from the city of Boston, who is deriving perhaps three times the profit from a very few acres devoted to strawberries, which grow almost spontaneously on these hills, and which you can grow without the particular cultivation which he is obliged to bestow upon them on the sands of the Cape, which you derive from your large farms of hundreds of acres. He could tell you a story which would astonish you. He has made himself independent by the cultivation of a very few acres of the sand-hills of the south-eastern portion of the State. Now, you are going to have these advantages one of these days, and your attention will be turned in a different direction, and then this great question of fruit and vegetable culture will be of more importance perhaps than your grass and pasture lands.

Mr. Converse, of Palmer. I would like to ask if any gentleman has studied Hungarian grass enough to know in what stage it should be cut? We raise a good deal of it, but we do not think it is good hay. We think it is on account of the wet weather, or else we were not rightly instructed when to cut it.

Mr. Lewis. I asked my friend Stone if I had better say

anything on this subject, and make a fool of myself again, and he said I had! You know I have become a sort of laughing-stock to the people of Barre already. But now, in sober earnest, gentlemen,—for there is no joking about this question of grass,—our friend here (Prof. Stockbridge), who is a perfect Nebuchadnezzar on grass, has told you exactly what you ought to do and what you must do. I came here to tell you how good grass was. I came here to tell you, and I tried to on Tuesday, that the Lord made the cow to eat grass, or else he made the grass for the cow to eat,—which I cannot tell, but the Professor can,—and that you could not substitute anything in its place for the cow. You cannot afford to, gentlemen. When you grow this fodder-corn to take the place of grass, you are doing an up-hill business, unless you grow it for winter-feed. I have learned one thing since I came to Barre in regard to curing this sowed-corn that I shall never forget; and that is, that you want to cut it up in season for winter-food, and lay it up on a stone-wall! This is the Barre system of curing corn! And you possess advantages in that respect that everybody does not have. I should not wonder if, in the far-distant future, it made a ready market for your surplus stone-wall.

Now, gentlemen, "all flesh is grass," you know, and we trace grass right through the machine that manufactures it into milk, into butter and into cheese; and it is to the people of Barre, in my opinion, the most important question that has come before this meeting. It is that upon which the dairy-interest is founded; it is that upon which the very prosperity of the United States rests.

A Voice. A little louder.

Mr. Lewis. I was telling them that grass was king, and they are laughing at it so much that I shall not say much more. (Cries of, "Go on!") I think I will leave you, by simply expressing the hope that you may grow grass enough to feast all your stock, and have a surplus that the Professor may feast his eyes on.

Mr. Root. Please give us your experience in re-seeding land,—what grasses you sow, and in what quantities.

Mr. Lewis. I could hardly give you the kinds nor the quantities, for I cannot think of either. I sow every kind for

a pasture that I can think of, and then I buy every other kind the dealers can think of. This gives me a succession of grasses throughout the summer. For my mowing-lands,—I understand that what I call meadows you call mowing-lands, and what you call meadows is something doubtful, I do not know what it is,—for my mowing-lands I get five or six different kinds. I took the light that sprung from Flint,—*Flint* light, you know,—for my meadow-seeding. I take four or five kinds, at least, of those grasses that ripen about the same time, for my meadows. I do not like orchard-grass in a meadow. I take exception to the Professor's recommendation in that respect; it comes forward too soon for the other grass. You want for your meadow grasses that mature at the same time, and you want to cut them all before they go out of blossom. I hope you will not forget that. They then contain all the nutrition that they ever can or ever will contain. And if you let them stand until they lose that nutrition, you can never bake, fry, boil or stew the nutrition back into them; and if you have got to sprinkle meal over your hay, and hire your cattle to eat it in that way, you are doing a very silly piece of business. It is almost like skinning a flint with a good jackknife, to feed a cow with old woody fibre, and hire her to eat it by a sprinkling of meal. Cut your nice, nutritious grass, cure it well, and the cow will be satisfied, and you, too.

Now I have said all I know, and more, too; and I will only say this in conclusion: that I have met a set of men here in Barre who, I believe (I do not care how discouragingly my friend, the Professor, has talked here to-day), are going to do better than they have done. I think they are a class of progressive farmers, and that they will take this matter right up and go ahead and astonish the world with what they do; and when you have practised all we have preached to you to-day, we will preach a little more.

Dr. WAKEFIELD. I suppose that some of these gentlemen may ask me to state my experience in clearing bushes, because some of them may know what I have done. I told you yesterday, gentlemen, that I went on to that farm about five years ago. It carried then about twenty-five cows. It is now able to carry forty cows easier than it carried twenty-five

then, and the pasture-lands have been improved in this way. A great part of the pastures were covered with bushes, in many places so high and thick that you could not see a cow. "How shall we remove these larger bushes?" was the first question. Well, I contrived an instrument, something like a stump-puller, put on one or two yoke of oxen, hitched into the bushes, and pulled them up by the roots. Many of them had got to be so large, that there was a large stump that we could not cut except with an axe, and then it would start again; but if we could contrive any way to take it out by the roots, there was an end of it the first time. I took those out in that way all over the pastures of that farm, in the course of two or three years.

Then they were covered with another class of bushes. We had the hardhack, but not the tall kind, of which the gentleman from Lenox has spoken; they were the same kind that grow around here. Those were all pulled up by hand. If you take it in the spring of the year, after the frost comes out and when the ground is soft, you can pull them right up. That settled those. Then we had briers. I had no sheep, except four cossets, and those I put among the cows, and they ate some of them. But we had large quantities of brakes, and sheep won't touch those to my knowledge. I have, however, three or four hundred boys, and about June, when the brakes began to have heads on them, I set the boys into them, and they pulled them all off. That did not kill them. They grew again in July or August, and I put the boys in and they did the same thing again, and those brakes are disappearing. The boys are going to conquer them. Then I have ploughed something like forty acres, where I needed the stone, and have cleared them of stone and eradicated the bushes where I ploughed. Where it is so stony and so steep that it won't do to plough, we mow them. We have to mow them year after year; but I believe with Prof. Stockbridge, if you stick to them you conquer them. Why do I believe so? Because I find that every successive crop comes up smaller and smaller. I find, in looking over them the next year, that there are many dead stems that have not started, although many of them do start. Now, how do I remedy that? When they come up and start I put my boys in, and

if they don't bite them off they pull them off, and I think that is just as effectual. I know those bushes are disappearing, and that is the way I manage them. You cannot all have three or four hundred boys, I know, to do this work, but that is the way I have utilized them. And it is good for the boys, because it is teaching them to work, and it is exercise for them. And if, after they graduate from our college, they do not want to pull brakes, they have learned to work, and they can do something else.

Mr. HUBBARD. I want to say just a word, because I know something about the land of which the Doctor has spoken, and there is a little more that I want him to say in this connection. I should like to know whether it was profitable to make the attempt to clear that land; whether it is profitable for farmers to expend their energies upon such land as upon land from which they can get greater returns.

Dr. WAKEFIELD. I cannot say whether it would be profitable for anybody else, but I am sure it was profitable for the State; for the boys, when they did this work, would have been doing nothing, and the men worked at it when it was not necessary for them to be employed in anything else. All I can say is, that I am satisfied I can show you that that farm has been managed, on the whole, so that there has been a profit of thousands of dollars.

President CLARK. I came here at the beginning of this meeting with the intention of staying through, and with the full expectation that I should learn enough to pay me for having come, and I believe I have. I have been very much interested in what I have heard, and some of it, I think, will do me good in years to come. I do not live in Barre, but in a very different country, and I should like very much to hear the experience of some of the Barre farmers in regard to this matter. They are specially interested in it; they have undoubtedly carefully thought over it, and had a great deal of experience; and as I am not acquainted with a great many, I propose to call for one in particular whom I know to be a clear-headed, sensible man,—at least he was in his youth when he was down in Boston in the legislature. I would like to hear Mr. Holland's views on the subject.

Mr. HOLLAND. Perhaps I cannot do better than to say

what I have to say in a sort of review of some matters which have been thrown out as the discussion has progressed. I believe that fodder-corn in Massachusetts or in Worcester West, is a necessity, and for this reason: there is no crop that we grow, that I know of, that is so sure to mature to the state of being fodder as corn. You give it a good place and not much tillage, and you are sure of a crop. You can plant it at a time when you are sure you are not going to get a good crop of hay, and you will not be obliged to sell your cattle at a low price to prevent their starving, or forced to go into the market and buy grain at high prices to keep them. This year I ploughed up a piece of ground on the 20th of June, and got a good crop of fodder-corn, and it is in my barn now.

With regard to feeding cattle, my experience is, that we must commence in the morning, or when we commence to feed, with poor fodder. It is a very good practice, I think, to throw in a little poor fodder at night, as the cattle will work it over during the night, and consume a considerable portion of it. I do not find any difficulty in keeping my cows in good flesh by feeding corn-fodder, and all that second quality of fodder, and I think I know, indeed, that I can keep my cows in as good flesh as any I have ever seen in the State of New York. I don't know of any in Herkimer County that do better. I will admit what the gentleman (Mr. Lewis) says in regard to our poor fodder; but I think if you should ask some of our farmers here in Worcester West what was the chief end of man, they would say it was to get a living; and I don't think we can afford to keep our cattle entirely upon grass.

Now I wish to make some remarks with reference to President Clark. As I understood him, he said science opened all the doors, and yet he said we did not know anything.

President Clark. I beg your pardon.

Mr. Holland. I cannot be mistaken. He said we did not know what manures were good, or what fertilizers were good, until science had tested them.

President Clark. No; I said you did not know what good was in them, that was all.

Mr. Holland. Well, I cannot see the difference, and as long as I don't I will go on. But in regard to that, I believe

that when you sift the matter down, it comes to this: the farmer who sees that he gets a good crop by a fertilizer, will believe that it is a good thing, science or no science; and if he sees that he don't get a good crop, no number of certificates will make him think that fertilizer is a good thing. I have no doubt that science may aid us greatly in these matters, but I wish the aid was more apparent than I see it.

With regard to Prof. Stockbridge, I agree with some things that he has said somewhat. I am not a very thorough believer in underdraining, not to the extent that I understand some go. I do not believe in stagnant water, or water that is flowing over the surface; but there should be a sufficient quantity of water in the soil when winter commences to freeze, and to operate in such a way as to tear the roots of the grass some; for I believe the roots of grass need pruning as much as the limbs of apple-trees. In that way our permanent meadows, as they are called here, are kept in the condition they are, and they are susceptible at all times to manure. I find that if I apply manure to dry lands, it don't seem to do much good, unless it be an exceptionally wet season, when I don't care much about it; but if I apply that same manure to a piece of land that is moist, I feel pretty sure I am going to get a return that present season.

Mr. Lewis. A careful, judicious dairyman like Mr. Holland or Mr. Ellsworth, can sometimes work in fodder that is not quite so good as the best, but I hope they will not recommend it to others, because other men do not take as good care of their stock as these two men do, and I am told that it is a dangerous practice to recommend. I merely make this suggestion that they may think it over, and see what bearings it will have. There is not one dairyman in a hundred who takes so good care of his cattle as Mr. Holland and Mr. Ellsworth, and they can do some things with impunity that other men cannot do who give their cattle less care.

Now in regard to one or two points that were brought out in the discussion to-day. One was by my friend Moore. I do not believe that a man with such a great heart as I believe him to possess intended any wrong in what he said, and yet it pained me to hear him say what he did. I declare here, Mr. Chairman, that if I was not fixed and hampered by the

business and social relations of life which forbid it, I would to-morrow enter the Agricultural College and commence at the foot of the lowest class. Old as I am, I believe I could learn something, and I believe that it would do me good.

Mr. Flint. Prof. Stockbridge has alluded, in his very suggestive and admirable lecture, to certain teachings of the State Board of Agriculture, and among others to the treatment of lands that have been properly laid down, in such a way as to leave the inference that the Board disapproved of frequent ploughing and maintained that once laid down they had better be left for the turf to thicken up and become fully set with good nutritious grasses. I do not know to what particular essay or action of the Board he alludes, nor do I recollect that any unqualified advice of that kind has ever been given by the Board as one of its directions for the management of the farm.

Circumstances and soils differ so much that even if it were true, here and there, that grass-lands do better to remain as they are, it would hardly do to lay it down as a rule of universal application. It is probably true, that with our imperfect modes of seeding, the use of so few of the many varieties that are naturally to be found in an old field, the turf will thicken up by the growth of many grasses that come into the soil, in the course of time. This will for some years continue to increase the yield, so that the field will appear to be growing better after it is laid down, especially if the soil is strong and good, or naturally suited to grass. But this increase must have its limit, even in the best of soils, without the judicious application of manure. The profitable growth and constant removal of grass and hay will lead to a depletion of the soil as true as the laws of nature are fixed and immutable.

But a large portion of our soils are not especially adapted to grass. Good crops are grown upon them with constant and increasing difficulty and labor, and though the liberal application of manure may keep them productive for a time, they soon begin to "bind out" as we say. The soil will get filled up and crowded with the roots of twitch or couch grass, or other objectionable permanent growths. We see instances of this every day on our lighter and poorer soils, especially where they are not often and liberally top-dressed, and this

on most farms is practically impossible, or at least so difficult and expensive that it is not often done. On our drier upland knolls and plains the droughts of summer or the formation and continuance of ice upon them in the winter, will kill out many of the better grasses, in spite of all we can do, and it would be unreasonable to expect such lands to continue to improve indefinitely. In fact the crop will and does deteriorate, in the course of time, and grow less and less.

We find, therefore, that so far from leaving such lands in permanent grass, there is a growing inclination to subject them to some cultivation, even more frequent than was formerly practised, something that may be called the annual forage-crop system, by which the whole farm, or rather all the grass-land of the farm, is put under the plough as often as once in three or four years. Indeed, I know farmers, in this room, whose whole tillage-land has been under the plough within three years, and who have settled down upon this as the most profitable system for them to pursue, especially since our seasons of terrible drought and our hard, open winters have so seriously affected all our grass-lands as to reduce their supplies for winter-feeding.

The process is to plough up deeply and thoroughly early in the fall, let the land lie in the furrow till spring, put on the harrow or the cultivator as often as once a week or ten days to keep down the weeds, and give it a partial fallowing, till the middle of June, and then sow on millet or Hungarian grass with a light top-dressing and roll or bush in the seed and the manure. By the tenth of August or thereabouts the crop will be fit to cut, and so far as my observation has gone, where the land is light and in fair condition, the yield has been from two to three tons to the acre of a good quality of winter forage.

The land is ready then to be ploughed up again, the turf sufficiently mellowed by frequent working to lay down to grass with another light dressing to give the seed a rapid and strong start, and if a sufficient variety of grass-seed is sown the result will be a better crop of grass than it had borne for some years previously. I have known grass-lands greatly improved in this way and at little expense. The mere process of cultivation, loosening and breaking up, has been a

positive benefit, while there has been no loss, but rather an increase of the winter stores of forage.

The great and prevailing error in laying down land has been insufficient seeding, or rather seeding with too limited a number of varieties of grass-seed. The result is a poor, thin turf, and of course a light crop of grass. It takes too much time to wait for other grasses to come in and occupy the spaces left vacant by too light seeding with one or two varieties of grass, and if the suggestions already made upon this point by Mr. Lewis and others, should lead to an improvement of our practice in this respect, we shall soon see larger crops and an improved system of farming.

The Board then adjourned.

ANNUAL REPORT OF THE COMMISSIONERS ON CONTAGIOUS DISEASES AMONG CATTLE.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts.

The Commissioners on Contagious Diseases among Cattle, in presenting to you their annual report, feel that they have occasion for congratulation, that while in some portions of the country, and abroad, disease has committed most fearful ravages, yet in our State, during the year past, cattle have been almost entirely exempt from prevailing sickness, and no contagious disease has visited them. In the month of March last, the attention of the Commissioners was called to what the citizens conjectured to be an alarming case of contagious pleuro-pneumonia in a herd in the town of Lenox, Berkshire County.

On Tuesday, the 2d of April, an examination was made. The barn, built of stone and situated on a hill, had been occupied for nine years, during which time no unusual sickness had occurred. About the 1st of March, the owner first noticed that some of his cattle were sick; he sent for a veterinary surgeon, who pronounced the animals affected with pleuro-pneumonia, and treated them accordingly.

On examination of several sick animals which were selected for the purpose by the owner, it was evident that disease of the lungs existed.

On removing the walls of the chest of a cow which died a week previous, the left lung was found consolidated, presenting the usual appearances of pneumonia; there was no effusion in the thorax, nor any evidence that pleuritis had existed. After returning to the barn, a more thorough examination was made of the animals; several were found so severely affected that recovery seemed impossible. The owner was requested to forward the lungs to the Commissioners, of one which was selected for the purpose, after the death of the animal.

The lungs were received the 14th day after the examination and were examined, presenting the same general appearance as the one examined at the farm.

The left lung was thoroughly consolidated, the right only about one-third; the remainder appeared normal; the interlobular tissue *was not thickened*, as was always found in the case in contagious pleuro-pneumonia; the pleural membrane covering the lung was not inflamed and showed no evidence of effusion having at any time existed.

In reply to inquiries, Mr. Ford writes, date June 3d: "We had on the 1st of March sixty-three head of cattle, and have lost twelve cows since; seven others have slunk their calves, four of which are dry. All the stock, except seven head, have been ailing, coughing more or less; they are all improving now, we think, but they give but littie milk." A letter was sent to Mr. Ford on the 19th of December, soliciting a statement of the condition of the herd at the present time. No answer has been received. From the examination of the animals before and after death, and their history (no animal having been brought to the farm from November to the time of the outbreak of the disease), it is evident that endemic pneumonia was the disease which prevailed among the cattle belonging to Mr. Ford.

European writers report such a disease as occasionally occurring among cattle; yet this is the first instance which has come under the observation of the writer during nearly thirty years' practice among domestic animals.

During the past year, diseases among horses have occurred, of an unusual character, entailing great losses, not only to horse-owners, but subjecting the whole business community

to inconvenience,—in fact, nearly blocking the wheels of trade.

In February, 1872, many horses in Boston and vicinity were attacked with a disease called spinal-meningitis; by some, paraplegia or paralysis of the hind-quarters. The animal would appear in the usual health when put to work, but, after going a short distance, would be unable to proceed and with difficulty would be got back to the stable. If taken early and treated properly, it is not a fatal disease. A stimulant should be given at once, after which a laxative (linseed oil is as good as any), followed by counter-irritation applied over the loins (mustard paste thoroughly applied to the skin), with blankets of hot water to keep up the warmth. In some cases it is necessary to raise the horse upon his feet, supporting him by slings, otherwise the animal will get bruised,.so that recovery would not be desirable. With good food and careful nursing, a large percentage of those attacked recover.

Another disease of a more serious character, though not commonly fatal, made its appearance in this vicinity in September. We first heard of it in Canada; afterwards it spread over all the New England States, and finally to every part of our country.

It appeared in the form of catarrhal fever, affecting the schneiderian membrane from the nostril to the fauces; occasionally, but rarely, extending to the tracheæ or lungs. A description of the symptoms of the disease is unnecessary, as nearly every horse-owner has recently witnessed them. In the treatment, the symptoms are the guide; debility always exists. Good, nourishing food, easily digestible, warm clothing, good air to breathe, friction to the skin and extremities, *with long continued rest*, are the essentials for recovery.

At the time the Board submitted its last annual report there was an unexpended balance of the appropriation of 1871, of one thousand eight hundred and forty-two dollars and thirty-one cents ($1,842.31).

In accordance with the provisions of law this balance must now revert to the general treasury, leaving the Board powerless to perform the duties of their office should an emergency occur requiring their action. The legislature in its wisdom will determine the propriety of making a small appropriation

to enable the Commissioners to meet any necessity which may arise. During the past year the Commissioners, in the discharge of their duties, have expended fifty-nine dollars and eighty-eight cents ($59.88).

LEVI STOCKBRIDGE,
E. F. THAYER,
Commissioners on Contagious Diseases among Cattle.

ANNUAL MEETING OF THE BOARD.

The Board met at the office of the Secretary in Boston on Monday the 3d of February, 1873, at 12 o'clock, A. M., His Excellency Governor WASHBURN in the chair.

Present.—Messrs. Agassiz, Allis, Baker, Brown, Clark, Fearing, Hadwen, Hubbard, Hyde, Knowlton, Ladd, Loring, Miles, Moore, Root, Saltonstall, Slade, Stone, Stockbridge, Sturtevant, Washburn and Wilder.

After the reading of the records a committee was appointed on the order of business, consisting of Messrs. Loring, Fearing and Root.

While the committee were out, the Secretary read extracts from the Annual Report.

The committee on the order of business then submitted the following

REPORT:

1. Reports of Delegates to the County Exhibitions.
2. Reports of Committees on Subjects assigned for Essays.
3. Report of the Committee on the Agricultural College.
4. Miscellaneous Business.
5. Appointment of Delegates.

The sessions to begin at 10 o'clock, A. M., each day. The committee also suggest that the committees on the selection of subjects for Essays and on the Annual Country Meeting be appointed on Wednesday morning.

(Signed) GEORGE B. LORING.
ALBERT FEARING.
THOMAS P. ROOT.

The report was accepted, when Messrs. Slade, Moore and Hubbard were appointed a committee to consider and report upon the times of holding the exhibitions of the county societies.

The reports of delegates being in order, Mr. Miles reported upon the Middlesex North; Mr. Goodman (read by the Secretary) upon the Middlesex South; Mr. Brown upon the Worcester South; Mr. Allis upon the Hampshire, Franklin and Hampden; Mr. Hyde upon the Middlesex; Mr. Sturtevant upon the Hampshire; Mr. Allis upon the Deerfield Valley; Mr. Stone upon the Berkshire; Mr. Allis upon the Highland; Mr. Root upon the Hampden East; Mr. Knowlton upon the Union; Mr. Hubbard upon the Hoosac Valley; Mr. Stone upon the Norfolk; Mr. Slade upon the Plymouth; Mr. Hadwen upon the Marshfield; Mr. Clark upon the Martha's Vineyard, and Mr. Myrick (read by the Secretary) upon the Barnstable.

These reports were laid over under the rule for a second reading and action.

Voted, That a committee of three be appointed by the chair to consider and report a list of subjects for investigation and essays. Messrs. Stockbridge, Hubbard and Sturtevant.

Voted, That a committee of three be appointed by the chair to consider and report upon the time and place of holding the country meeting of the Board. Messrs. Stone, Hadwen and Root.

Dr. Loring presented the following,—

THIRD ANNUAL REPORT ON THE INJURIOUS AND BENEFICIAL EFFECTS OF INSECTS.

By A. S. Packard, Jr., M. D.,

Entomologist to the State Board of Agriculture.

Though the reporter was absent during most of the past season, and was unable, except in a slight degree, to make any special investigations on the habits of our more injurious insects, yet with the help of others some new material is here offered that may be serviceable to farmers and gardeners. The facts that we have to present may often seem disconnected and desultory, but few except experts in natural history are perhaps aware how difficult and prolonged a task it is to follow out the transformations of any particular insect, and study thoroughly its habits in its different stages of growth. Unlike birds, quadrupeds and fishes, which have

similar habits at all stages of growth, an insect, with its three separate stages of larva, pupa and adult, leads as it were three separate lives, with different surroundings, and in each of those stages may be regarded as so many different animals. Then it is often extremely difficult to ascertain to what beetle or moth or bee such and such a grub or caterpillar belongs. Our entomologists are not numerous enough, and often from their time being taken up with the pursuit of their profession, usually not that of science, are unable to spend the time in the field to observe the habits of insects for themselves. Unfortunately, also, so backward is the science of entomology in this country, that the attention of its students is at present fully engrossed with classifying and describing the adult insects. When it is to be borne in mind that there are within the limits of the United States, probably at a low estimate, ten thousand (10,000) species of *Hymenoptera* (bees, wasps, ichneumon flies, saw-flies, &c.), half as many butterflies and moths, about ten thousand species of flies, as many of beetles and of bugs *(Hemiptera)*,—Mr. Uhler, our authority on this group assures me this is a fair estimate of their number,—and several thousand species of grasshoppers, &c. *(Orthoptera)*, and neuropterous insects, such as dragon-flies, caddis-flies, &c., &c., the whole amounting to upwards of fifty thousand species of insects, to say nothing of the spiders, mites and ticks, centipedes and millepedes, it is evident that in the mere preliminary work of identifying and properly describing these myriad forms—an intellectual work requiring as much good sense, discretion and knowledge as shown in the pursuit of medicine, the law or education,—that all this work, which is simply preliminary in its nature, is a vast one, and that the combined exertions of many minds over several generations will not exhaust the subject. As it is, there are in this country only about thirty entomologists who publish anything relating to insects. Necessary as it is, this work of classification is by no means the highest and most useful branch of physical science. He who studies carefully the habits and structure of one insect, and if injurious to agriculture lays before the farmer and gardener a true story of its mode of life, is a true benefactor to agriculture, and at the same time benefits science more than he who describes hun-

dreds of new species. Such an one was Dr. Thaddeus W. Harris, whose leisure moments were consecrated to the benefit and advancement of the agricultural interests of our State, and the Commonwealth, perhaps, never made a better investment than in supplying the agricultural community with an illustrated copy of his immortal work. On looking over Dr. Harris's work we find that he mentions about six hundred species as injurious to vegetation, and as others have been added since then, it is not improbable that we have at least one thousand destructive species, i. e. about one-tenth of the entire number (10,000) of insects which undoubtedly are to be found living within the limits of this State. As to the losses sustained from their attacks it would be difficult to say how great they are, but it is to be estimated at least by hundreds of thousands of dollars. The amount of waste by the agency of insects is really appalling, and even now but slightly appreciated by our farming community.

We have perhaps little idea how many insects are preying upon our crops and shade and ornamental trees. Perhaps there are, within the limits of our country, one-tenth of the number, i. e. five thousand, given above, which are either at present engaged in the work of injury, or are destined to be, with the growth of civilization, which means in this instance the destruction of the natural food of these insects and the substitution of a different diet—our choicest grains and fruits in their stead.

During the last summer the canker-worm was as destructive as ever, and it seems to have gained a firm foothold among us. It is scarcely creditable that so conspicuous and comparatively easily assailed an insect as this does so much annual damage. It would seem as if the birds did not feed upon it to much extent. We have personally never seen birds feeding upon the canker-worm, though Professor Wyman states that doves eat them sometimes in large numbers. As we have stated in a former report there are certain kinds of caterpillars that birds do not relish. Indeed birds seem to have certain fancies of their own among edible insects. Thus the martin will store up in its nest quarts of the common striped beetle of the potato, to the exclusion of all other insects.

The reporter would be greatly obliged for any facts upon this subject communicated by those who may have a chance to observe what birds feed on particular kinds of insects and at what season and month of the year.

Our cranberry crop has been grievously ravaged during the year past, though the writer has no information to give at present in relation to this subject farther than that recorded in the article entitled "New and Little Known Insects," in the Report on Agriculture of the State for 1870, and that given in the author's "Guide to the Study of Insects," though he has visited several cranberry pastures during the recent autumn. In conclusion, before offering the accompanying remarks on certain injurious and beneficial insects, the reporter would invite the attention of agriculturists to those insects that prey on the cranberry crop and other injurious insects, and beg them to communicate to him at Salem, specimens and information about their habits and extent of ravages which may be of use in making up the next year's report.

INSECTS INJURIOUS TO THE STRAWBERRY.

The May Beetle.—With the increasing attention paid to the culture of the strawberry, it has been found that several insects not before suspected to be inclined to feed on this plant, now habitually frequent it. Of these perhaps the most injurious is the strawberry saw-fly, which in this State, but more especially the Western States, as in Illinois, does in some cases the most grievous damage. Then a few moths which have been known to feed on fruit-trees, the currant, &c., have transferred their affections to the strawberry; such are apple-leaf-roller or *tortrix*, the saffron measuring-moth *(Angerona crocataria)*, and several other caterpillars found in the Western States, and described in the entomological reports of Messrs. Walsh & Riley, and also in Harris's Treatise on the Injurious Insects of this State, and the reporter's "Guide to the Study of Insects."

Next however in importance to the strawberry saw-fly *(Emphytus maculatus)*, is one of the most common and familiar of all these insects which everywhere force their attention upon us. This is the common May beetle, June beetle or "dor bug," the American representative in its abundance and injurious qualities of the European cockchafer.

Dr. Harris has given a brief sketch of its habits and transformations in his "Treatise," and referred to the injury the grub, sometimes called "white-worm," does to the roots of grass, remarking that "in many places the turf may be turned up like a carpet in consequence of the destruction of the roots." He however does not say that it attacks the strawberry-roots, which it has for several years been known to do in gardens about Salem. My attention was especially called to its ravages by Mr. D. M. Balch, of Salem, who has lost a good many strawberry-plants by the white grub. It seemed evident that they were introduced in the manure placed around the roots, as during July and late in summer, a manure-heap near by swarmed with the well-known white grubs, in various stages of development, some apparently in the second year and others in the third year's growth. They eat the main roots of the plant, thus destroying one plant after another. From this it will be obvious that if we observe the plant to wilt and suddenly die, we may look for the white grub and at once kill it to prevent farther ravages. It is evident, so large and voracious are these worms, that one plant would be a mere trifle to one of them.

It also eats down in much the same manner young squash-plants, as I am told by Mr. C. A. Putnam, of Salem, who has been obliged to plant the seed over once or twice. They attack young plants at the time when they have thrown out three or four leaves. It is obvious that in dealing with this destructive insect we must become familiar with its habits. Every one knows the larva or grub of this insect, so that a detailed description is not necessary. It (fig. 1) is a large,

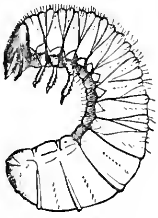


Fig. 1.—Larva of May beetle.

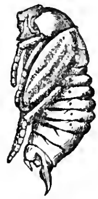


Fig. 2.—Pupa.

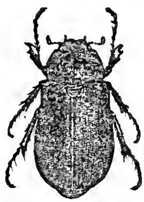


Fig. 3.—May beetle.

soft-bodied, thick, white worm, nearly as large as the thumb. Its head is yellowish or pale horn colored. Its skin is so thin

and transparent that the air-vessels and viscera can be seen through it, while though it has three pairs of legs, it is so gross and unwieldly that it lies, when dug out of its retreat, flat upon its side.

How many years the grub lives before changing into the beetle we do not know, but probably at least three. It arrives at maturity in the autumn, and early in May in this State the chrysalid (fig. 2, pupa) may be found in little rude cells or chambers about six inches under the mould, in which position we have found it in Maine late in May. During the latter part of May and early in June, i. e. for about a month it flies about at night, especially on warm nights. By day it hides in fruit and other trees, clinging to the undersides by its long, curved claws, which are admirably adapted for the purpose. Here it does at times much injury especially, as Harris remarks, to cherry-trees.

Where it lays its eggs is not definitely known, but it is probable that it burrows in the soil and there lays its eggs, as does the European cockchafer of whose habits Harris gives a summary, and also the Goldsmith beetle, of which we give an account farther on. Riley however says that "Soon after pairing, the female beetle creeps into the earth, especially wherever the soil is loose and rough, and after depositing her eggs to the number of forty or fifty, dies. These hatch in the course of a month, and, the grubs growing slowly, do not attain full size till the early spring of the third year, when they construct an ovoid chamber, lined with a gelatinous fluid; change into pupæ, and soon afterwards into beetles."

In the autumn at the approach of cold it descends to a considerable depth below the surface to avoid the frost, probably about two feet below the usual depth at which the ground is frozen in the winter. At the approach of warm weather, however, it makes its way up near the surface, where it forms a slight cell by wriggling about, and then passes into the pupa state. It is said that they sometimes pupate and appear in the winged state in the autumn.

As to remedies against this grub, the careful gardener will in the first place destroy all those that he sees by crushing them to death. When the manure is spread over the strawberry-bed he must watch it narrowly for the grubs so easily

seen, and kill them. When a vine is seen to die down suddenly in summer he must then dig around the roots and search for them, and go over the bed carefully, even if help has to be employed. It is better to spend even much time and money for two or three years in succession, in endeavoring to exterminate these grubs, than to yield passively to the scourge. The remarks of Mr. Lockwood that we reprint in our account of the Goldsmith beetle are eminently practical as applied to this insect. As for special remedies, we have none to propose. Watchfulness and care in culture are better than any special nostrums.

Undoubtedly the natural enemies of this grub are many, but we have no observations bearing on this point. A fungus attacks the grub in certain seasons, often in considerable numbers. We have received specimens from Missouri of dead and dried grubs, with a long stem growing out from them, the result of the attacks of this fungus. It has been figured by Mr. Riley, who states that another fungus attacks this worm in Virginia. It is well known that caterpillars and even the common house-fly are sometimes attacked by a fungus which replaces the animal portion with its own vegetable substance.

While many animals, such as the skunk, mole, crows, &c., prey on the beetles, the only insect enemy I have personally noticed is the fierce carnivorous Calosoma beetle *(C. calidum)* which I have noticed on a blueberry-bush busily engaged in tearing open the hard, horny sides of one of these beetles, who was in vain struggling to escape; on taking up the May beetle a large hole had been eaten into its side disclosing the viscera.

Occasionally the beetle appears in immense numbers. It is then the duty of the agriculturist to pick them off the trees and burn them. If the French take the pains to practise hand-picking, as in one instance "about eighty millions were collected and destroyed in a single portion of the lower Seine" (Riley), our gardeners can afford to take similar pains.

A description of the May beetle is scarcely necessary. The admirable figure, taken from Harris's work, (fig. 3) gives a good idea of its appearance and size. It is bay colored, or

chestnut and brown, with yellowish hairs beneath, and is nearly an inch in length. Its scientific name is *Lachnosterna fusca*, or, literally translated, the brown woolly-breasted beetle. The pupa (fig. 2) with that of the larva taken from the "Guide to the Study of Insects" is white.

The Goldsmith Beetle.—We also have in this State an insect allied to the preceding, and with much the same habits, both in the adult and preparatory states. It is the *Cotalpa lanigera* (fig. 5). It is nearly an inch in length, bright yellow above, with a golden metallic lustre on the head and thorax, while the underside of the body is copper-colored, and densely covered with white hairs.

Dr. Harris says that it is very common in this State, remarking that it begins to appear in Massachusetts about the middle of May, and continues generally till the twentieth of June. "In the morning and evening twilight they come forth from their retreats, and fly about with a humming and rustling sound among the branches of trees, the tender leaves of which they devour. Pear-trees are particularly subject to their attacks, but the elm, hickory, poplar, oak, and probably also other kinds of trees, are frequented and injured by them." Dr. Lockwood has found it on the white poplar of Europe, the sweet-gum, and has seen it eating the Lawton blackberry. He adds that the larvæ of these insects are not known; probably they live in the ground upon the roots of plants.

It has remained for the Rev. Dr. L. Lockwood to discover that the grub or larva of this pretty beetle in New Jersey devastates strawberry-beds, the larva feeding upon the roots, in the same manner as the May beetle. His account was first published in the "American Naturalist," (vol. II. pp. 186-441). He says that in the month of May in the ordinary culture of his garden the spade has turned up this beetle generally in company with the May beetle. He found that some of the beetles, as in the case of the May beetle, assume

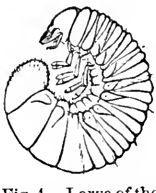


Fig. 4.—Larva of the Goldsmith beetle.

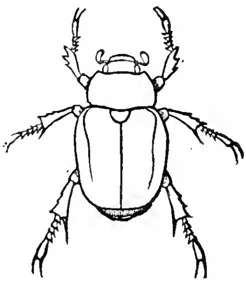


Fig. 5.—Goldsmith beetle.

the adult beetle state in October and remained underground for seven months before appearing in the spring.

The larvæ (fig. 4) he describes as "whitish grubs, about one inch and three-quarters long and over half an inch thick, with a yellowish-brown scale on the part corresponding to the thorax." I may add that it so closely resembles the young of the May beetle that it requires a close examination to tell them apart. The proportions of the two are much the same,—if anything the *Cotalpa* is slightly shorter and thicker, and its body is covered with short, stiff hair, especially at the end, while in the May beetle the hairs are much finer, sparse, and the skin is consequently shiny. They also differ in the head, being fuller, more rounded in *Cotalpa*, the clypeus shorter and very convex, while in the May beetle it is flattened. The upper lip (labrum) is in *Cotalpa* longer, more rounded in front and narrower at the base, and full, convex on the surface, while in the young May beetle it is flat. The antennæ are longer and larger in the Goldsmith beetle, the second joint a little over half as long as the third, while in the May beetle grub it is nearly three-quarters as long; the third joint is much longer than in the latter grub, while the fourth and fifth are of the same relative length as in the May beetle, but much thicker. The jaws (mandibles) are much alike in both, but not quite so acute in the *Cotalpa* as in the other, nor are the inner teeth so prominent. The maxilla is much longer and with stouter spines, and the palpi are longer and slenderer in the grub of *Cotalpa* than in the other, though the joints have the same relative proportion in each; the basal joint is nearly twice as long as in the May beetle. The under lip (labium) is throughout much longer, and the palpi, though two-jointed in each, is much longer and slenderer in the grub of *Cotalpa* than in that of the May beetle. The feet are much larger and more hairy in the *Cotalpa*. Both larvæ are about an inch and a half long, and a third (.35) of an inch thick at the widest part.

As regards the number of years in the life of this insect, Dr. Lockwood observes that "when collecting the larvæ in May, I often observed in the same places grubs of the *Cotalpa* of at least four distinct ages, each representing a year in the life of the insect, judging from Renny's figures of the larvæ of

the English cockchafer, or dor beetle (*Melolontha vulgaris*). But the English chafer becomes an imago in January or February, and comes forth into active life in May, just four years from the deposit of the egg. Supposing our *Cotalpa* to take on the imago form in autumn, and to spend its life from that time to the next May in the ground, it would be five years old when it makes its debut as an arboreal insect." It is possible that Dr. Lockwood may be in error regarding the age of this beetle, as M. T. Reiset says in France this insect is three years in arriving at its perfect beetle state. The following remarks on the habits of the European chafer may aid observers in this country in studying the habits of our native species. M. Reiset says (see "Cosmos" as translated in the "American Naturalist," vol. II., p. 209) "that this beetle in the spring of 1865 defoliated the oaks and other trees, while immense numbers of their larvæ in the succeeding year, 1866, devoured to a fearful extent the roots of garden vegetables, &c., at a loss to the department of the lower Seine of over five millions of dollars. This insect is three years in arriving at its perfect beetle state. The larvæ hatched from eggs laid by the beetles which appeared in such numbers in 1865, passed a second winter, that of 1867, at a mean depth in the soil of forty one-hundredths of a metre, or nearly a foot and a half. The thermometer placed in the ground (which was covered with snow,) at this mean depth, never rose to the zero point* as *minimum*. Thus the larvæ survived after being perfectly frozen (probably most subterranean larvæ are thus frozen, and thaw out in the spring at the approach of warm weather). In June, 1867, the grubs having become full-fed, made their way upwards to a mean distance of about thirteen inches below the surface, where, in less than two months, they all changed to the pupa state, and in October and November the perfect beetle appeared. The beetles, however, hybernate, remaining below the surface for a period of five or six months and appearing in April and May. The immature larvæ, warned by the approaching cold, began to migrate deep down in the soil in October, when the temperature of the earth was ten degrees above zero. As soon as the snow melted they gradually rose towards the surface."

* By the centigrade thermometer.

As regards the time and mode of laying the eggs, we quote from Dr. Lockwood as follows: "On the evening of the 13th June last we caught in the drug-store, Keyport, whither they were attracted by the profusion of light, four *Cotalpas*, representing both sexes. These were taken home and well cared for. On the 16th a pair coupled. A jar of earth was at once provided, and the beetles placed on top of the dirt. In the evening the female burrowed and disappeared. Near midnight she had not returned to the surface; next morning she had re-appeared. The earth was then very carefully taken from the jar, and, as removed, was inspected with a glass of wide field but low power. Fourteen eggs were found, not laid (as we expected) in one spot or group, but singly and at different depths. I was surprised at their great size. Laid lengthwise, end touching end, two eggs measured very nearly three-sixteenths of an inch. They were like white wax, semi-translucent, in form, long-ovoid and perfectly symmetrical. On the 13th of July one had hatched; the grub was well formed and very lively. Its dimensions were about five-sixteenths of an inch in length and about three-thirtieths of an inch in thickness. It was a dull white, the head-plate precisely that dull yellow seen in the adult grub, the legs the same color, and the extremity of the abdomen lead-color, the skin being transparent. For food, a sod of white clover *(trifolium repens)* was given them, roots downward, knowing that the young larvæ would come upward to eat. They were then left undisturbed until August 19th, when the sod was removed, and it was found that the grubs had eaten into it, thus making little oval chambers, which were enlarged as the eating went on. They were carefully picked out and a fresh sod of grass and clover supplied. They had now grown five-eighths of an inch in length, preserving the same colors.

It is quite possible that a few of the eggs escaped me in the search. I am of opinion, however, that from fifteen to twenty is the average number laid by one beetle. In short, the insect lays her eggs in the night, probably not more than twenty. The hatching of these required in the present instance twenty-seven days. It must be remembered that a large portion of this time was remarkably cold and wet. It is almost certain that with favorable thermal conditions this might be lessened fully seven days.

Regarding its ravages in strawberry-beds, I cannot do better than quote from Dr. Lockwood's excellent account in the "American Naturalist": "When on a visit in September last to the farm of a celebrated strawberry-grower in Monmouth County, N. J., my attention was directed to certain large patches badly thinned out by, as the phrase went, 'the worm.' The plants were dead on the surface and easily pulled up, the roots being eaten off below. It was observable that the fields which presented the worst appearance were all of the same kind of plant,—that known as Wilson's Albany Seedling. Besides this there were nine other varieties under culture,—Barne's Mammoth, Schenck's Excelsior, the Agriculturist, Triomphe de Gand, Cutter's Seedling, the Jucunda, Pineapple, Early Scarlet and Brooklyn Scarlet. While the Wilson stood second to none of these as a prolific fruit-bearer, yet it fell behind them in vigorous plant-growth. Hence, while every kind was more or less affected, the other varieties seemed saved by their own growth and energy from a destruction so thorough as was that of the Wilson. These patches were all planted in the spring, and all received the same treatment, the ground being kept open and free from weeds. The amount of the spring-planting was seven and a half acres. Of the Wilsons there were three different patches in places quite separated from each other, and on not less than five different kinds of soil. These patches were among and contiguous to those of the other varieties. While all suffered more or less, the chief injury befell the Wilsons, of which not less than two acres were irretrievably ruined. An examination turned up the depredator, who was none other than the larvæ of the Goldsmith beetle, now engaged in the first one of its allotted three-summer campaigns of mischief. These grubs were from the eggs deposited in June in the well-tilled and clean soil, which, I have said elsewhere, I thought the *Cotalpa* preferred to meadow or grass lands. Compared with others, the larva of this beetle is sluggish and easily captured. The black grub of the spring, which is such a pest, attacking almost indiscriminately the early tender plants, inflicts its injuries chiefly in the night, the exception being that of dull and cloudy days. The night's mischief done, it descends into concealment at early dawn. Knowing this, the wise farmer

is in search of it at an early hour, ere the warmth of the sun gives it warning to retreat. But the Goldsmith grub can be taken at any hour of the day simply by scratching away the earth from around the roots of those plants whose dark, shrivelled leaves tell of the enemy's presence. It is my belief that this devastation might have been spared by an outlay of from \$20 to \$30 for labor, of which, under proper direction, much could have been done by children. Therein would have been saved a strawberry crop for the ensuing summer, worth scarcely less than \$2,500, for from this same farm the crop of a single acre has been sold for \$1,500. Then, however valuable such labors are in the immediate results, that is but a fraction of their worth as respects the future. These *cotalpa* grubs, with all their mischief, had not more than a third of their ultimate size; hence their real ravenousness is yet to come. Besides, what a prospect of increase of numbers, should even a moderate share of them reach maturity? Why should not our farmers seek to know something about their insect-enemies, and when practicable put forth some energy to meet as such?"

Snails Injurious to the Strawberry.—Under this caption Prof. E. T. Cox publishes in the "American Naturalist," (vol. II., p. 666), a note regarding the injury done in Indiana by a little snail *(Pupila fallax)*, at present found occasionally though not abundantly in this State. Though this report refers chiefly to insects, yet gardeners are undoubtedly in the future, as civilization advances and the country becomes more thickly settled, destined to be plagued by these little animals, and a slight notice of them may not be out of place, as the ravages they commit may be sometimes wrongly attributed to insects.

It seems that Mr. and Mrs. Chappelsmith of New Harmony, Indiana, "found their strawberry-plants dying rapidly, and on seeking for the cause discovered these molluscs at work upon the stems and crowns of the plants, rasping off the outer coating, and sucking their juices in such a manner as to cause them to decay. Mr. C. found as many as forty upon one plant, and thinks they have killed several thousand upon the different beds. Though more abundant on the strawberry, he has found them on a variety of plants. Since attention has been called to the depredations of these minute mol-

luses, they have been found at work upon the strawberry-plants in all the gardens examined."

Though this species is not common with us, yet we have other kinds which are more or less so, and which may ultimately prove to be obnoxious. Yet it is not probable that snails will ever be so abundant with us as in Europe, as our climate is much dryer and hotter, snails needing a damp, rainy climate in order to flourish vigorously.

INSECTS INJURING THE BEAN.

The Bean-weevil.—In our article entitled "Injurious Insects New or Little Known," published in the Report of the Board of Agriculture for 1870, we described and figured the bean-weevil, which was then regarded as an imported species, the European *Beuchus granarius*, and some account was given of its habits. Afterwards in a short note published in our First Annual Report (p. 22), we stated that it was not an importation, but a native species which for some years has been known to be injuring the bean in New York and the Middle States. It was mentioned under the unpublished or manuscript name of *Beuchus varicornis* (Leconte). The same year Mr. Riley described it in his report on the injurious insects of Missouri under the name of *Beuchus fabæ*, and states that it appeared about ten (1862) years ago in Rhode Island, according to Mr. F. G. Sanborn, and is now known to appear in Illinois and Missouri.

How extremely injurious this weevil has been, and still threatens to be, appears from both Mr. Riley's and my reports. We are sorry to add that this winter it is said to be very abundant in seed-stores in Boston, and unless checked in its course, a comparatively easy thing to do at this time, it will rapidly spread all over the State, and do incalculable injury to the bean crop.

I am indebted to Mr. C. A. Putnam, of Salem, for numerous living specimens of this weevil, with the beans from which they were emerging, obtained by him at a seed-store in Boston in February. We have figured in this report for 1870, the bean perforated by the grubs. It is easy to tell by the little round dark spot on the outside of the bean, i. e. the thin covering over the hole in which the weevil lies,

whether the weevil lies within. Now is the time to plunge all the beans in hot boiling water to kill the weevil—treating them just as gardeners have been accustomed to deal with the well-known pea-weevil. Such beans as are found to be affected should at once be burned. Again, as suggested by Dr. Harris, in dealing with the pea-weevil, "if the pease are kept till they are a year old, the insects will leave them." So that by keeping the seed for two years in tin boxes, or other dry situations, where the weevil may come out and die, without being allowed to go at liberty, the beans may be sown with impunity. By the exercise of a little care, and by combination among gardeners this pest may be kept under.

The grub or larvæ occurred February 10th in different stages of growth, the largest being one-seventh (.14) of an inch long and about half as thick (.08). Other grubs were only half as long. Some chrysalids occurred also at this date while the adult beetles were coming out of the beans. The larva is a very thick, white, fleshy grub (fig. 6) with the body much curved and the head very minute and sunken in the body. The rings are much flattened, the sutures obscurely marked, and the rings are each divided by a transverse line dividing it into two portions. There is a distinct, flattened, lateral ridge. The end of the body is much rounded and incurved. The head is white, becoming honey-yellow about the short, stout jaws.

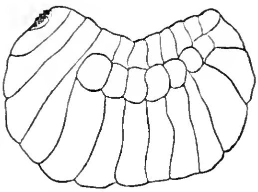


Fig. 6.—Grub of Bean-weevil.

One specimen was in the semi-pupa state, being intermediate between the larva and pupa. Its body was straightened out, the head being at the extreme end and now quite prominent, while before it was hidden in the soft body. The three succeeding segments were full and swollen, the third being very distinct from the succeeding one, the basal abdominal segment. The whole body was much flatter and thinner than in the grub. It was evident that the remarkable changes by which it becomes transformed into the chrysalis state had begun.

INSECTS INJURIOUS TO FRUIT AND FOREST TREES.

The Seventeen-year Locust.—This remarkable insect having, after its long absence of seventeen years, again, as had

been predicted by observers, made its appearance in the southerly parts of the State, we take this occasion to draw attention to its strange and unwonted habits, and to solicit aid from observers in the State in determining its natural boundaries. I should be greatly obliged if any persons in every town in the State in which it appeared would let me know of the fact, that we may ascertain its range. While it has been known to appear in the south-eastern part of the State, and even as far east as Plymouth, situated on Massachusetts Bay, we want to know in what towns to the north of this it has appeared. The point is of much interest to naturalists, as in determining the northern boundary of the district it inhabits, which undoubtedly accords with certain lines of temperature which regulate the distribution of many other insects and plants, we may throw much light on the physical geography and meteorology of our State. The cicada also often does much injury to fruit-trees, especially in the West, and it is thus, aside from its deeply interesting and unique mode of life, an object of solicitude to farmers.

The most remarkable fact about this creature is, that while so far as we know, the other species of cicada pass but a year in attaining the winged state, the present one lives underground over sixteen, assuming at the end of seventeen years the perfect winged state. We have seen that the May beetle is about three years in obtaining the beetle state, and the wire-worms and boring-beetles, such as the apple-borer, may be four or five years in the larval condition, but no other insects are as yet known, with this sole remarkable exception, to be so long-lived in their immature state.

The remarks that we have to make are simply supplementary to what the reader may find in Dr. Harris's admirable account in his "Treatise." He brings out the important fact that these insects are said, in the larval state, to do much injury to apple and pear trees by drawing the sap from the roots, so that the tree may decline in health for years without any apparent cause. This needs to be substantiated by farther observation. As regards the kinds of this I may quote from a communication from William Kite in the "American Naturalist," vol. II., p. 442, as confirming and adding somewhat to Dr. Harris's statements: "Seeing in the July number

of the 'Naturalist' a request for twigs of *oak* which had been stung by the so-called seventeen-year locust, I take the liberty of sending you twigs from *eleven* different varieties of trees in which the females have deposited their eggs. I do this to show that the insect seems indifferent to the *kind* of wood made use of as a depository of her eggs. These were gathered July 1st, in about an hour's time, on the south hills of the 'Great Chester Valley,' Chester County, Pa. No doubt the number of trees and bushes might be much increased. The female, in depositing her eggs, seems to prefer well-matured wood, rejecting the growing branch of this year, and using last year's wood and frequently that of the year before, as some of the twigs enclosed will show. An orchard which I visited was so badly 'stung' that the apple-trees will be seriously injured, and the peach-trees will hardly survive their treatment. Instinct did not seem to caution the animal against using improper depositories, as I found many cherry-trees had been used by them, the gum exuding from the wounds, in that case sealing the eggs in beyond escape.

"The males have begun to die, and are found in numbers under the trees; the females are yet busy with their peculiar office. The length of wood perforated on each branch varied from one to two and a half feet, averaging probably eighteen inches; these seemed to be the work of one insect on each twig, showing a wonderful fecundity.

"The recurrence of three 'locust-years' is well remembered in this locality—1834, 1857, and 1868. There has been no variation from the usual time, establishing the regularity of their periodical appearance."

As regards the time and mode of hatching, Mr. S. S. Rathvon of Lancaster, Pa., contributes to the same journal some new and valuable facts, which we quote: "With reference to the eggs and young of the seventeen-year cicada, your correspondent from Haverford College, Philadelphia, is not the only one who has failed to produce the young by keeping branches containing eggs in their studios. I so failed in 1834 and 1851, and indeed I have never heard that any one has succeeded in that way, who has kept them for any great length of time. In the brood of 1868, the first cicadas appeared here in a body, on the evening of the second day of

June. The first pair *incoitra*, I observed on the 21st, and the first female depositing on the 26th of the same month. The first young were excluded on the 5th of August. All these dates are some ten days later than corresponding observations made by myself and others in former years. On the 15th of July I cut off some apple, pear and chestnut twigs containing eggs, and stuck the ends into a bottle containing water, and set it in a broad, shallow dish also filled with water, the whole remaining out of doors exposed to the weather, whatever it might be. The young continued to drop out on the water in the dish for a full week, after the date above mentioned. I could breed no cicadas from branches that were dead and on which the leaves were withered, nor from those that from any cause had fallen to the ground, and this was also the case with Mr. Vincent Bernard, of Kennet Square, Chester County, Pa. After the precise time was known, fresh branches were obtained, and then the young cicada were seen coming forth in great numbers, by half a dozen observers in this county. As the fruitful eggs were at least a third larger than they were when first deposited, I infer that they require the moisture contained in living wood to preserve their vitality. When the proper time arrives and the proper conditions are preserved, they are easily bred, and indeed I have seen them evolve on the palm of my hand. The eyes of the young cicadas are seen through the egg-skin before it is broken."

Mr. Riley, in an interesting account of this cicada in his "First Annual Report on Noxious, Beneficial, and other Insects of Missouri" for 1869, has shown that in the Southern States thirteen-year broods of this insect are found. He remarks: "It was my good fortune to observe that besides the seventeen-year broods, the appearance of one of which was recorded as long ago as 1633, there are also thirteen-year broods, and that, though both sometimes occur in the same States, yet in general terms, the seventeen-year broods may be said to belong to the Northern and the thirteen-year broods to the Southern States, the dividing line being about latitude thirty-eight degrees, though in some places the seventeen-year brood extends below this line, while in Illinois the thirteen-year brood runs up considerably beyond it. It was also ex-

ceedingly gratifying to find, four months after I had published this fact, that the same discovery had been made years before by Dr. Smith, though it had never been given to the world."

Mr. Riley predicts that in southern New England a brood will appear in 1877 and 1885. Probably the Plymouth brood which appeared in 1872, will not appear again for seventeen years, namely, in 1889, the two broods noticed by Riley appearing west of this town. As regards its appearance in Plymouth, in this State, Harris states that it appeared there in 1633. The next date given is 1804, "but, if the exact period of seventeen years had been observed, they should have returned in 1803."

Mr. B. M. Watson informs me from his personal observation, that it also appeared in 1838, 1855 and 1872. In Sandwich it appeared in 1787, 1804 and 1821. In Fall River it appeared in 1834; in Hadley in 1818; in Bristol County in 1784, so that as remarked by Harris and others it appears at different years in places not far from each other. So that while in Plymouth and Sandwich we may look for its re-appearance in 1889, in Fall River it will come in 1885, or four years earlier.

There are three species of cicada in this State, and in order that they may not be confounded in studying the times of appearance of the different broods of the seventeen-year species I add a short description of each form, so that they may be readily recognized in the winged and immature states.

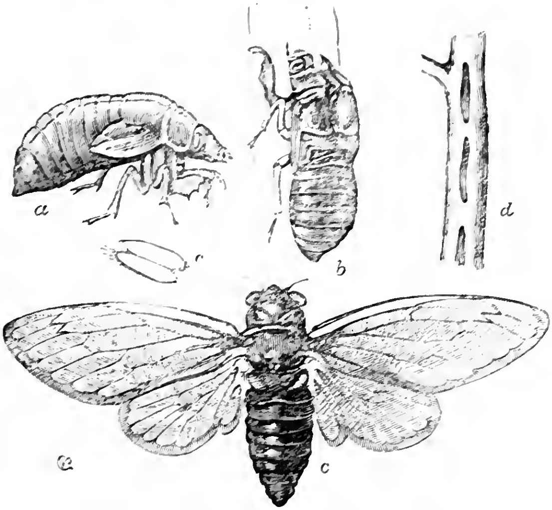


Fig. 7.—The Seventeen-year Cicada and Pupa.

The two largest species are the seventeen-year locust

(Cicada septemdecim) and the dog-day cicada *(C. pruinosa).* Fig. 7, copied from Riley's report, gives a good idea of this species; *a* represents the pupa; *b*, the same after the adult has escaped through the rent in the back; *c*, the winged fly; *d*, the holes in which the eggs *e* are inserted. Fig. 8 represents the larva as soon as hatched. The adult may be known by its rather narrow head, the black body and bright-red veins of the wings. The wings expand from two and a half to three and a quarter inches.

The pupa is long and narrow, and compared with that of *C. pruinosa*, the head is longer and narrower, the antennæ considerably longer, the separate joints being longer than those of the dog-day locust. The anterior thighs (femora) are very large and swollen, smaller than in *C. pruinosa*, though not quite so thick, with the basal spine shorter than in that species, while the snag or supplementary tooth is larger and nearer the end; the next spine, the basal one of the series of five, is three times as large as the next one, while in *C. pruinosa* it is of the same size, or if anything smaller. The toe-joint (tarsus) projects over two-thirds of its length beyond the end of the shank (tibia), while in the other species it only projects half its length. The terminal segment of the body is rather larger than in *C. pruinosa.* The body is shining gum-color or honey-yellow, with the hinder edge of the abdominal segments thickened, but no darker than the rest of the body. Length one inch (.90-1), width about a third of an inch (.35) being rather smaller than that of *C. pruinosa* and much larger than that of *C. rimosa.*

Fig. 8.—Larva of Seventeen-year Cicada.

The dog-day harvest-fly (fig. 9, from Harris's Treatise), may at once be known by its large head, as wide as the body, and by the green markings on the head and thorax, especially the W-shaped mark on the latter. It expands three inches, and is a larger and more bulky insect than the preceding. We know but little of its habits. Harris says that it invariably appears with the beginning of the dog-days, and in the vicinity of Boston he has heard it for many years in succession, with only one or two exceptions, on the 25th of July, for the first time in the season. According to Prof. A. E. Verrill, in

our "Guide to the Study of Insects," it lays its eggs in the stems of the solidago or golden rod. "It made a longitudinal incision with ragged edges into the pith of the plant, then with its ovi-positor forced its eggs a little distance down into the pith below the external opening; there were two rows of eggs succeeding the first single one, each pair diverging outwards, the lower ends of each pair nearly touching each other, and all placed very near together."

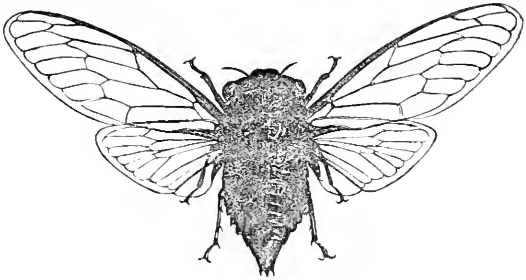


Fig. 9.—The Dog-day Cicada.

The pupa (fig. 10) is much the largest and thickest of the three species, being nearly twice as bulky as that of the two others. The head is very broad, short, triangular, much shorter than in the seventeen-year locust. There are no dark bands crossing the body. It is an inch in length and nearly one-half (.45) an inch wide.

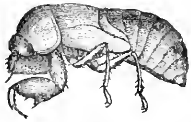


Fig. 10.—Pupa of Cicada pruinosa.

One smaller species, the least cicada (*C. rimosa*), expands a little less than two and a half inches, and has a narrow head, with bright red markings on the head and thorax. For several years in Brunswick, Maine, I have noticed that it began its sóng on the 10th of June, and in this State it probably sings by the 1st of that month.

Its pupa (fig. 11) is in most respects intermediate between the first two species. The head is broadly triangular, like that of *C. pruinosa*. The antennæ have shorter and smaller basal joints, and not much larger than the second, while they are very unequal in size in the two other species; the third joint is much shorter than that of *C. septemdecim*. The front of the head is much more hairy than in the others. The thorax is shaped much as in *C. pruinosa*, but the insect differs from both species in having a broad, dark brown conspicuous band on the hinder edge of each thoracic and abdominal ring.

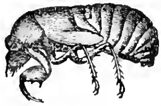


Fig. 11.—Pupa of Cicada rimoso.

The anterior femora are rather shorter than in the other species, but on the whole more like those of the seventeen-year cicada than the *C. pruinosa*. The spines are large and heavy; the basal one like that of *C. pruinosa*, but rather shorter and broader, with the tooth situated nearer the base. Of the five inner teeth the first one is twice as large as the second. Near the end of the tibiæ are two well-marked teeth, much more distinctly marked than in the other two species, which have but one low appressed tooth in their place. The tarsus projects about a third of its length beyond the tip of the tibia. Length .80, breadth .35 inch.

The Brachys Leaf-miner.—This and the following beetle have the singular habit of mining the leaves of plants. It is rarely that beetles live this sort of life, though many caterpillars and maggots of flies are leaf-miners. Dr. Harris has given in his Treatise an account of the larva of Hispa which mines the leaf of the apple-tree, eating the pulpy substance between the upper and under surface of the leaf. The two insects of which we now treat belong to the family of Buprestids, several species of which do much injury to our fruit and shade trees in the grub state. They are footless grubs and recognized by the broad, rounded, flattened segment just behind and partially enclosing the head. The young of the following insects depart somewhat from this typical form owing to their peculiar leaf-mining habits. The first of these is the young of the *Brachys æruginosa* which has been found by V. T. Chambers, Esq., of Covington, Ky., mining the leaves of   , and I am indebted to him for a specimen of the larva here figured. (Fig. 12.)

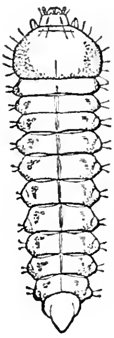


Fig. 12.—Larva of Brachys.

I may remark here that a closely allied beetle *(B. terminans)*, I have often found resting in the leaves of the oak and beech. The beetles of this genus are flattened, angular ovate, and less than a quarter of an inch in length, and the scutellum is small, as Leconte observes, while the shanks (tibiæ) are linear. In the succeeding genus, Metonius, Leconte says that the body is triangular, while the scutellum is large, and the shanks are dilated. The body of the larva is rather long, with the segments very deeply cut, being flattened, and

produced laterally into triangular projection, giving a serate outline to the body, the teeth being obtusely rounded. The segment next behind the head is the widest, the succeeding segments gradually decreasing in width and increasing slightly in length to the end. The terminal segment is about half as wide as the body in its widest portion, and is somewhat triangular, with the sides parallel, and the tip obtusely pointed. The prothoracic segment or the one next the head is broader than long, and with a fleshy projection on each side at the base of the head. On the upper side of this segment is a large, square, slightly horny area. The head is anterially pale honey yellow, with two dark longitudinal parallel lines; the horny portion is about as long as broad, much flattened, subtriangular. The antennæ are very minute, slender, three-jointed, with the joints nearly equal in length. The jaws and palpi are so minute that a description will be of no practical use here. The body is finely shagreened, with a few fine scattered hairs. It is whitish, with a slight greenish tinge, and a quarter (.25) of an inch long, and less than a tenth (.07) of an inch broad. It was sent to me alive in September.

The Tick Trefoil Leaf-miner.—This insect *(Metonius lævigatus,)* which is not uncommon in this State, has been found by Mr. V. T. Chambers of Covington, Ky., mining the leaves of the tick trefoil *(Desmodium)* during the early part of September. The larva is from .15 to .20 inch in length, and mines a broad, irregular patch, sometimes only half the length of the leaf, but often it extends its burrow around the end of the mid-rib, half way down the other side of the leaf. The track of its burrow is irregularly sinuous. At the end of this gallery or burrow it forms a round chamber just as wide as the body is long, disc-shaped, the walls being convex, the cell looking like a smooth, regular blister.

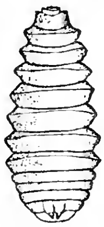


Fig. 13.—Larva of Metonius.

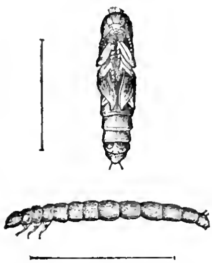
The grub (fig. 13) differs greatly in form from the preceding one, the body being quite thick, but little flattened, being rather convex above and below; in form oval lanceolate, widest in the middle, tapering much more rapidly posteriorly than toward the head. The segments, especially those of the abdomen, very convex on the sides, being produced triangularly into very acute

teeth. The prothoracic ring is about the same width as the fifth abdominal ring, being narrower than the mesothoracic ring and having the sides somewhat sharply pointed, while those of the succeeding (metothoracic) segment are rounded. The eighth abdominal segment, or one next to the last, is transversely oblong, and about two-thirds as wide as the seventh. The ninth and last is a little over one-half as wide as the eighth. It gives rise to a minute projection at the end. The prothoracic segment and head are closely soldered together; the two together are transversely ovate elliptical, full convex on the front edge, the separation between the head and the succeeding ring being indicated by a slight notch. The anterior surface of the head is somewhat flattened, with a small, squarish, pale, horny area. The horny portion of the front of the head is very minute compared with the similar part in the Brachys larva, and is scarcely perceptible except under high magnifying powers. The body is uniformly pale greenish, and the skin is smooth. The differences between the two larvæ are most remarkable, when we consider how closely the beetles resemble each other.

The Spotted-necked Languria.—This beetle is allied to Trogosita, an insect which is known to be injurious to housed grain, though the grub is still more intimately related to the European *Nemosoma elongatum*, which is found under the bark of elms in burrows inhabited by Hylesinus, a wood-boring beetle. Having received the Languria in all its stages of growth, from Mr. Belfrage of Texas, though the insect occurs in the Middle States, it is thought that a description of it will not be out of place in a report on economic entomology, as some members of the group to which it belongs are known to be destructive. The adult beetle was first described by Say (under the name of *Languria puncticollis*) from Ohio. It is pale reddish, with the forelegs, wing-covers and end of the body black, with a large distinct black spot in the middle of the neck (prothorax). It is said by Mr. Say to frequent flowers.

The larva (fig. 14) is unusually long and slender, cylindrical, the body being of uniform thickness throughout, whitish, with smooth segments. The head is but little narrower than the rest of the body; the eighth ring of the abdomen is as

large as the rest, while the ninth is much smaller, being rounded and bearing two dorsal, upcurved, acute hooks. There are a few scattered hairs over the body. The six thoracic legs are well developed, and there is a stout, short anal prop-leg. As usual there are nine breathing-holes (stigmata) on each side of the body. The head is somewhat flattened, squarish, the postclypeus (as we may call the triangular inclosure in the top of the head), shield-shaped with apex acute, and with two shallow pits (eyes?) on each side of the middle. The true clypeus is short, transverse. The feelers (antennæ) are inserted on the side of the head, and are as long as the clypeus is broad; they are four-jointed, with the third longest, the fourth very slender, not quite so long as the second. Upper lip (labrum) transversely oval, elliptic, the front edge curved, and the surface moderately convex. The jaws (mandibles) are stout, black at tips, three-toothed, the upper tooth small, the two lower ones equal. The maxillæ have four-jointed palpi reaching to the end of the closed mandibles; the joints of nearly equal length; the third slender, but scarcely longer than the basal joint. The labium, the lower or under lip, is small and situated on a long, narrow mentum; the palpi are two-jointed, the joints sub-equal, the second but a little longer than the first. Length of body .65; thickness one-tenth of an inch (50 specimens.) The pupa (fig. 15) is white, long and slender, with the club-shaped antennæ reaching to the middle of the anterior tarsi; the tarsi of the middle pair of legs reaching to the hinder edge of the first abdominal segment; hinder pair of legs concealed, with the exception of the femora-tibial joint, by the wing-covers, the latter being long, pointed and ribbed; they reach to the end of the fourth abdominal segment. Near the hind edge of each segment is a dorsal ridge, bearing stiff hairs, and from three to seven unequal sharp spines, which on the sixth segment are arranged in two irregular rows, with six larger than the rest, and tipped with black. On the terminal segment are two large, equal, erect, long and slender blackish spines, and a pair of ventral, sharp tubercles on the seventh segment.


Figs. 14 and 15.—Larva and pupa of Languria.

The body is naked, whitish, with a few scattered hairs along the sides. The head cannot be seen from above, being covered by the prothorax; it is rounded oval and free from the prothorax beneath, with a few short scattered hairs. It is about half (.50–.60) an inch long. (Thirty specimens.)

Of probably somewhat similar habits is the *Dacne heros* (fig. 16, larva and pupa, *a* upper, *b* under side of head), the early stages of which have been communicated to me by Dr. H. Shimer, of Illinois. The grub of an allied species *(D. fasciata)* found in this State, is said by Candèze to live about New Orleans in the diseased trunks of the palmetto. It is not known what tree it inhabits in this State.

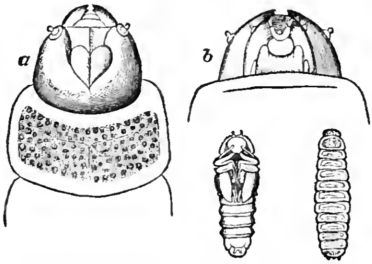


Fig. 16.—Larva and pupa of Dacne.

BENEFICIAL INSECTS.

The Apis-eating Lady-beetle.—Among the insects which do incalculable benefit to agriculture, are several kinds which prey almost exclusively upon the Aphis or plant-louse. The Syrphus flies in the maggot state, devour great quantities, and so do the larvæ of the lace-winged fly (Chrysopa). Scarcely less valuable aids to the gardener are the young of the "Lady-bird" beetle (Cocinella). During the past summer we have traced the transformations of a species *(Psyllobora 20-maculata*, Say) which lived in all its stages on the leaves of the horse-chestnut during the month of August. As no aphides were seen on the leaves I am inclined to think that in this instance the food of the young lady-bird was certain freshly-hatched Proci (Coecilius), aphis-like neuropterous insects which were running about over the leaves, masses of their eggs being attached to the leaves, and as usual covered with a thin web. Indeed some cocinellæ feed on the eggs and young of their own kind. This lady-bird is a very small beetle, a tenth of an inch long; pale, whitish yellow, including the legs and antennæ. There are four black spots on the prothorax, and nine on each wing-cover, two on each wing-cover usually running together, thus making twenty distinct spots in all.

The larva (fig. 17) is long and slender, with a rather small head, which is a little over half as wide as the segment (prothorax) next to it; it is somewhat trapezoidal in form being widest in front, a little longer than broad, with black, conspicuous eyes consisting of four or five raised facets. The stout, minute antennæ are two-jointed, the joints being of equal thickness, the second a little shorter than the first. The upper lip (labrum) is small, transversely broad ovate, with the front edge rounded. The jaws are quite small. The maxillæ are very large, obtuse cylindrical, projecting far beyond the head. The labium is small and short.

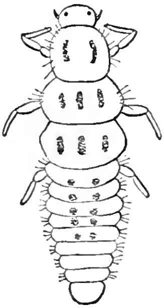


Fig. 17.—Larva of "Lady-bird."

The body is widest on the third segment behind the head, and shorter than the first segment, the three segments gradually decreasing in length; while the abdominal segments are nearly equal in length, and very convex laterally. The form of the terminal (ninth) segment I could not make out, as all my specimens were preparing to affix themselves to the surface of the leaf, and this segment was greatly enlarged and elongated, ending in a soft and membranous ruffle-like dilatation by which the insect was evidently about to gum itself to the leaf.

The body is covered with short, stiff hairs. It is white, with two dark spots on the segment next the head, four on each of the two following segments, and two on the five succeeding segments; these spots are thickened portions of the skin, giving rise to hairs. The legs are stout, the toe-joint ending in a single claw, with four or five tenant hairs at the end of the joint. Length about a seventh (.15) of an inch.

The pupa is of the usual form in the group, but is white, with two faint dorsal dark spots on the middle thoracic segment, and two on the basal segment of the abdomen; farther behind is a pair of large, converging, black spots beginning on the second abdominal segment, and ending on the fourth; while on each side of the fourth are two dark spots. There are two slight dorsal spots on the fifth segment. The body is usually provided with a few fine, scattered hairs, but in a very small specimen (.06 inch long) the upper side is

densely covered with long, thick hairs, the body being naked beneath. The larger specimen measured .12 inch in length.

The Aphis-eating Mite.—Quite an unsuspected enemy of the aphis is a little garden-mite, which I found in July and August last in considerable numbers in my garden, busily engaged in devouring the plant-lice on the rose-bushes.

We know but little of the numerous kinds of mites which abound in this country, and but few species are known to prey on other insects. The present species is allied to the red garden-mite (*Trombidium*), which is often seen running over flower-beds. It is the six-legged young of these mites which, under the name of harvest-mites, are so irritating and annoying when they get upon our bodies, as they work their way in under the skin. Their natural hosts are various insects, such as grasshoppers, &c., as we often perceive them with their heads stuck in between their joints. They are all vermilion-red in color, and in former times have been used as a dye.

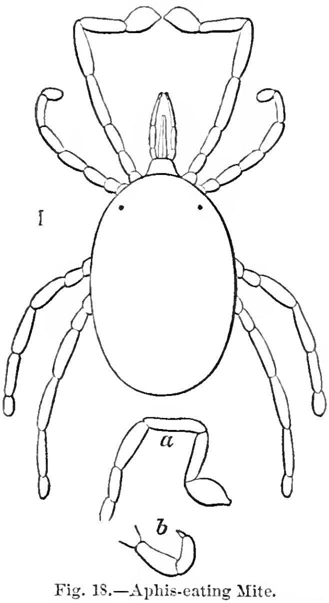


Fig. 18.—Aphis-eating Mite.

Our species is apparently a *Trombidium*, or closely allied genus, and perhaps the specimen we figure here is immature. It may be called *Trombidium? bulbipes*, (fig. 18, *a* leg, *b* palpus, side view,) in allusion to the swollen, bulb-like terminal joints of the legs. It is scarlet red, regularly ovate in form, with a distinct, squarish head separate from the body, and two deep-red eye-spots situated over the insertion of the second pair of legs. The beak is long, slender, sharply conical, and reaches to near the middle of the third joint of the palpi; the latter four-jointed, the second and third joints of nearly equal size, the fourth very minute; when extended the palpi reach nearly to the end of the third joint of the first pair of legs. The fore-feet are much larger, thicker, and rather longer than the fourth pair, and inserted very near the head; the terminal joint is

much swollen, ovate, the preceding joint being slenderer than the others. The second pair are about half as long as the first pair. It is deep scarlet-red, and the body and limbs are densely covered with short, stout hairs. This species, though quite different in the form of the body, yet in the proportions and form of the legs and mouth-parts is congeneric with the European *Trombidium Papillosum* of Hermann, which is said to live on the trunks of trees and in moss.

PEABODY ACADEMY OF SCIENCE,
SALEM, Feb. 3, 1873.

SECOND DAY.

The Board met at 10 o'clock, A. M., Col. LEAVITT in the chair.

Present,—Messrs. Agassiz, Allis, Baker, Birnie, Brown, Bucklin, Clark, Fearing, Hadwen, Hubbard, Hyde, Knowlton, Leavitt, McElwain, Miles, Moore, Phinney, Peck, Root, Saltonstall, Slade, Stockbridge, Stone, Sturtevant and Wilder.

Mr. HUBBARD was appointed a committee to examine and report upon the credentials of new members.

Mr. LADD submitted a report upon the Worcester North Society, Mr. Birnie upon the Housatonic, Mr. Peck upon the Nantucket, Mr. Boise (read by the Secretary) upon the Worcester South-East.

Prof. STOCKBRIDGE submitted the following essay upon

THE USE OF STEAM ON THE FARM.

Within the last fifty years the perfection of the steam-engine and its general employment as a motor, has completely revolutionized all the great commercial and manufacturing industries of the civilized world. In point of fact, it has become the corner-stone on which modern social, civil, military and business structures rest, and is a prime cause of the grand distinction between the past and present. In most departments of human labor its application has more than quadrupled man's power over matter, space and time, and made that perfectly feasible, a daily accomplishment, which a generation ago was an absolute impossibility. By its rapid and tireless motion it has virtually annihilated distance, speeding away the traveller across continents and oceans, and giving

him the pleasure or profit of circumnavigating the globe during a brief business or school vacation. Comparatively, it has stripped matter of weight and immobility by transporting with marvellous velocity and titanic power the most ponderous freights by land and sea,—lifting to the surface with the greatest celerity the gross products of the deepest mines, and excelling the mighty force of continental streams in its strength, reliability and adaptation as the propeller of all the varied forms of mechanical and manufacturing machinery. It has deprived the winds, waves and ocean-currents of their power and terror, and bears forth, in the face of all, rich cargoes of life and material, and passes on to its destination from port to port, almost with the certainty and regularity of the advancing day. We are now almost daily called to wonder at the improvement of the steam-engine and its marvellous versatility of adaptation. As occasion requires, it performs equally well the slowest and the most rapid motion, producing here the most delicate, and there the most gigantic results. On the right hand we behold it without apparent effort propelling the monster steamship, or dragging the long train of heavily-loaded cars, and on the left giving motion and effective power to an apparently inextricable network of the frailest machinery. It controls the morning and the evening editions of the daily press, sending forth its sheets by the hundreds of thousands to supply the wants of a reading nation, and far inland, remote from sea and from water-courses gives motion to every form of machinery, and fills the land with the sounds of prosperous activity.

But perfect as the steam-engine is, marvellous as are its adaptations in giving power and efficiency to many special forms of human industry, wonderful as are the changes it has wrought in the general condition, the prosperity and happiness of mankind, and much as we rejoice at all its accomplishments, yet we feel that it has failed, and will continue to fail, to perform the best and most important results of its high mission until its power is fully and directly applied to increase the quantity and cheapen the cost of the products of the soil. This is the very fountain of human want, and the power which creates the imperative supply needs all the aid and reinforcement which steam and steam-machinery can give. To adapt

the steam-engine to the farm, or to devise such a modification of our form of agriculture that it shall be adapted to the engine, is the great want of modern times, the securing of which demands study, skill and the highest intelligence.

In a general way, and indirectly, agriculture has been benefited by the steam-engine; and it is important that we know and appreciate those benefits, as well as what it has attempted to perform, and in what direction its aid is now most imperatively needed. Just in proportion to the aggregate of its marketable products, their need of quick and cheap transit in proportion to its need of reaching distant markets, agriculture has been equally benefited with other industries by the steam-engine as a transporting agent, or if it has not, it is owing to the supineness of those who pursue it. In the older and more thickly-settled sections of our country, labor on the farm has ceased to be simply an effort to produce directly from the soil, and in kind, all the food and clothing of the farmer's family, and has become the production of such articles as are required by some definite market. The farmer should therefore have the reliable, quick communication which steam alone can give, and if he has proper foresight it is generally available. The steam-engine has become so simple in its construction, so easily managed, and withal so cheap in its first cost, that it is unmistakably the best adapted to, and the most economical stationary power to be found on the farm, for the purpose of threshing, sawing wood, lifting and unloading farm products, and pumping water, in connection with the use of the steam in the preparing of food for various kinds of stock. On small farms, where there is very little of this kind of work to be performed, it cannot probably be used with profit; on large farms it can, though it is as yet but rarely employed. With these two items, steam as a means of public conveyance, and as a stationary power to do a very limited variety of farm labor, we have called attention to all that it has really and practically performed for agriculture. Most earnest thought and study have been given to the subject, and many attempts made to bring the power of steam to practical use in breaking up and tilling the soil; but to-day there is not a steam-plough in all New England, and probably not one in America, which, if it can succeed at all, is available to our scale and mode of farming.

Some account of the efforts which have been made in this direction, and the successes and failures which have attended them may not be useless, but may tend to call attention to the subject, indicate the course invention to this end is now pursuing, and what in the way of success or failure may be reasonably expected from the effort. So far as I have been able to ascertain, the first thought or attempt to use steam for the purposes of tillage, was in 1618, when a plan was prepared and a patent granted for it in England to David Ramsey and Thomas Wildgosse; but no machine was constructed, and the idea passed out of mind and remained practically unknown until about 1833, or more than two hundred years. In that year a patent was granted in this country to E. C. Bellinger, of South Carolina, for a hauling steam-plough. Bellinger constructed and tried his machine, but it proved worthless, and all attempts of his to improve it to the point of usefulness failed, and he abandoned the project. But in 1854 John Fowler, of England, adopted Bellinger's general idea, added many improvements of his own, and after constructing his machine was granted patents both in England and the United States, the latter in 1856 and 1857.

Fowler's first machines were crude in construction and inefficient in operation; but he persevered in his attempts at improvement until, after expending more than a quarter of a million of dollars, he so perfected them that they were practically so useful in certain circumstances as to create such a demand for the machines that John Fowler & Co., of Leeds, England, have to this time manufactured and sold nearly three thousand of them. More than five hundred estates in England are cultivated by them. They have been introduced in France; there are two hundred of them in the valley of the Nile, and two in this country,—one in Illinois and one on the sugar-plantation of Mr. Lawrence, of Plaquemine, Louisiana. Fowler's is the best type of what is called a hauling-machine. The engine is stationary on the headland of the field, and performs its labor by hauling a gang of five or six ploughs back and forth across the land by means of a rope and windlass secured by an anchor opposite to the engine, or by two engines, one on each side of the land to be ploughed, which in turn haul the ploughs and move forward on the headland as the work pro-

ceeds. It requires from four to six men to work the machine, which, with its ropes and rope-porters, its anchors, pulleys, gang-machine and engine would be called a complicated and unmanageable apparatus to perform so simple an operation as that of ploughing.

Patents have been granted in England to many persons for steam-ploughs, but none but Fowler's has stood the practical test or been acknowledged a success. In 1870 Lord Dunmore perfected a traction engine, light and simple in construction, which drew three ploughs, and on turf and heavy clay soil that had not been ploughed for forty years, ploughed five acres per day at a cost of one dollar per acre; but it has not yet appeared in the field as the competitor of the Fowler machine.

For the past fifteen years inventive genius in the United States has often been directed to this matter, and many patents have been granted; a large proportion of these efforts, however, ended with the securing of the patent. A few went so far as to construct a machine and bring it to the test of actual work, and these will be noticed in their order. All, or nearly all of our attempts have been more to invent a machine on the traction principle. Under the impetus of a premium of three thousand dollars offered by the Illinois State Agricultural Society, John W. Fawkes, of Lancaster, Pa., invented and constructed a traction steam-plough in 1857. It was tried at the state fair in Centralia in September, 1858. The soil was clayey loam, and very hard in consequence of drought, but it drew six ploughs, each cutting a furrow one foot wide and eight inches deep, and ploughed at the rate of three and one-half acres per hour. After ploughing two acres the committee pronounced it a decided success, and awarded it the premium. At a subsequent trial, however, in the month of November, on ordinary prairie-land, it signally failed. The inventor spent a year in making improvements, and presented it at the state fair at Freeport, in the fall of 1859, but it failed in power to reach the field designated for the trial, and was abandoned as useless. In 1859 James Waters, of Detroit, presented a machine of his own invention and manufacture for trial at the fair of the United States Agricultural Society at Chicago. The machine was thirty-seven feet in length,

twelve feet wide, with driving-wheels ten feet in diameter, and weighed seven and a half tons. The inventor claimed that it would haul thirteen ploughs, turning over a breadth of land nineteen feet wide, and plough sixty acres in a day. On trial it broke down after advancing three hundred feet and was condemned. In 1858 Thomas Burridge, of St Louis, Missouri, brought out a machine which on trial, was found to possess sufficient traction-power for the purposes of a hauling-engine, but was so large, heavy and unwieldy in the field as to be of no practical use. In 1863 A. W. Hall, of St. Louis, obtained a patent for, constructed and tried a machine on the principle of rope traction, but it proved to be of no practical use. From 1863 to 1871 invention was busy with the problem of the steam-plough, and several patents were granted, but nothing of practical use was produced. During the past year D. D. Williamson, of New York, has invented a road and field steamer, with Thomson's patent wheels improved by himself, and is now largely engaged in their manufacture. Hitherto the leading cause of failure with all traction engines has been to obtain sufficient traction to haul a load, and sometimes to even move the machine itself. In this machine the difficulty appears to be surmounted by the peculiar construction of the driving-wheels. These are of cast-iron, five feet in diameter, and sixteen inches breadth of rim or tire. This rim is thickly perforated with half-inch holes, and then surrounded with a vulcanized rubber tire four inches in thickness; surrounding the rubber tire is an endless chain of steel plates four inches in width, extending across the rim. The pressure of the machine on the wheels causes the rubber to protrude into the holes in the iron rim and holds it firmly to its place; the flattening of the rubber on the ground gives it two hundred square inches of traction-surface to each wheel, and its elasticity prevents injury to the engine by concussion in passing over rough roads and fields. The machine has been thoroughly tried the past summer, in various localities, and with unvarying success. Information obtained by correspondence with the manufacturer and patentee, with individuals who have witnessed its operations and on whose farms it has been used, indicate that it is capable of accomplishing all that is claimed for it, and that it is the first really successful traction engine.

It thus appears that for forty years effort more or less persistent and continuous has been made, and millions of dollars expended to devise a method by which the power of steam can be applied to improve and cheapen the tillage of the soil, and the only practical result is, that two patents have been so far perfected that they can be successfully used to a *limited* extent as compared with the broad field for which they are demanded. It is conceded that the Fowler engine can be successfully employed to plough, harrow, crush and subsoil; that its average day's work with ploughs on different kinds of soil is eight acres, at a cost from a dollar to a dollar and a half per acre; that it performs its work more thoroughly than it can be done by horses, and owing to better cultivation it largely increases the crop,—wheat on such land yielding on the average ten bushels more per acre than that cultivated by the ordinary method; and on sugar-plantations, where the previous cultivation had been very imperfect, the use of this steam-plough has increased the product of sugar one thousand pounds per acre. But on the other hand it must be said, that the cost of the machine, ploughs and tackle, which Mr. Fowler recommends as practically the cheapest of the three sizes or kinds he manufactures, is $4,500; its weight being about seven tons, would crush the ordinary bridges on our country and farm roads. It is very unwieldy, and can be profitably employed only on large fields and where the furrows are of considerable length. Though it is a more recent invention, and has not been so thoroughly tested, yet it is agreed by those who have employed it and seen it in operation, that the Thomson-Williamson traction engine is a success; that it will move on any ordinary road at the rate of ten miles per hour hauling a load of fifteen tons; that it is easily handled and guided, turns completely around in a circle eighteen feet in diameter; that it moves forward and backward, up and down grades of one foot in eight; that it will convey itself to the field over rough roads with all its ploughing apparatus, water and coal; that it will draw a gang of six ploughs, each cutting a furrow fourteen inches wide, up grades of one in twelve, and turn itself and again set in its ploughs at the end of the field nearly as quick as a horse-team, and plough according to the tenacity of the soil and its freedom from stones,

from eight to fifteen acres per day; that on average land it will plough at a cost less than a dollar per acre, and its quality of work and influence on the crop are equal to Fowler's machine, and like that, it is a good stationary-engine to be used for lifting, threshing, sowing, &c. The net cash price of this engine, with the gang of ploughs, is $5,500 in New York. Its weight, with coal, water and attendants on board, is more than six tons, and it is very doubtful whether it has been so severely tested as to prove that its great weight and complication will not seriously impair its usefulness even on large farms, common roads and ordinary friable soils. Admitting now that these two patents, Fowler's and Williamson's (the only ones out of hundreds that have been granted), are a success, and that they will accomplish all their inventors and manufacturers claim, it seems that they must utterly fail to meet our present want of steam-tillage. Their great cost, cumbersome proportions and complicated tackle, prohibit their general use, except on immense estates where there are hundreds or thousands of acres to be tilled, where the surface is but gently undulating and the soil firm or hard. The owners of the royal domains of the old world, and of some of the prairie-farms and sugar-plantations of our country, may have capital to invest and find it profitable to employ such means of cultivation; but the vast majority of our estates embrace only scores instead of hundreds or thousands of acres. The policy of our government, the genius of our people and institutions, all have a tendency to make a large proportion of our population land-owners, and it is morally certain that as it becomes more dense, there will be a tendency to diminish rather than increase the present size of farms, until we shall be, comparatively speaking, a nation of small farmers. It therefore seems certain, that such expensive, unwieldy machines cannot be useful to our future agriculture, and especially when we take into account the rocky nature of a large proportion of our soils and their uneven surfaces. Whatever may be the fact in relation to the present or future size of American farms, we shall need a better and cheaper power to secure for them such cultivation as the advancing age demands. It is an established fact that for all the ordinary purposes of transportation steam costs much less than horse-power, and I trust I am not

too hopeful and credulous when I say that the want is so great, the day cannot be far distant when means will be devised by which a large proportion of the heavy work on our farms now performed by men and horses will be performed by steam. The first step to be taken, as preliminary to extended farm-improvement in America, is thorough drainage. Millions of acres, now about worthless, would, by the process, be converted into the most productive and valuable land were it not for the hard labor and great cost of opening and closing the drains. To overcome this we demand a ditching-machine propelled by steam-power.

The demands of more thorough tillage, the breaking up and pulverizing of the subsoil on our hardpan farms, especially on the introduction of the sugar-beet culture, requires the introduction of its efficient and powerful force. We need steam for a large proportion of the heavy hauling of the farm,—to transport manures, sand, clay, muck, the crops; and when once applied to this, to be so adjusted as to perform or relieve much of its manual labor. Our farm-machinery of all kinds should be propelled by steam; and the same apparatus should perform the work alluded to at the barn, as well as preparing food for stock. One apparent cause of the failure of our mechanics and inventors to supply these wants hitherto, has been that they have attempted too much, and have failed to secure anything. A machine like that of Waters, thirty-seven feet in length, weighing ten tons, costing six thousand dollars, and ploughing sixty acres per day, even if it accomplished what was claimed for it, was not the kind of machine demanded by American agriculture; and all other engines possessing similar characteristics will fail to be generally introduced and useful. Another cause of the failure of American machines has undoubtedly been that their inventors have not found a practical method of securing a sufficient traction to propel them and at the same time to haul a load. All such sorts of contrivances attached to the wheels as clogs, hooks, prongs, blades, &c., have not succeeded, and when great weight has been given to the whole apparatus to give it a hold upon the ground, it has accomplished little else than to make it immovable. The steam-engine which will meet the present or future wants of our agriculture must be locomotive, moving itself

and hauling its load. Our people will not abide anything which will not travel, neither have they time to untwist and straighten the endless ropes and tackle of the Fowler system. The machine must move lightly and easily, and retain its hold on the ground by some peculiar form of its wheels, rather than by its weight, which should in no case exceed two and a half tons, and it should be so constructed as to be compact in form and easily guided, controlled and superintended by men of average intelligence. It should be able, with safety and without great effort, to work perpendicularly or horizontally on grades of one in ten. Its maximum cost must not exceed twenty-five hundred dollars, and it must haul at least three ploughs, each turning a furrow eight by twelve inches, and invert not less than six acres per day of ten hours, or twelve if running day and night. Its daily cost of superintendence, coal and water should not exceed ten dollars. But even such a machine would not be suited to the present condition of a majority of our farms, or our mode of managing them. This was true of them when our machinery for harvesting hay and grain was so perfected as to be practically and economically useful. When we found that, with the facilities afforded us, we could no longer afford to gather these crops by hand-labor, we in good earnest set about fitting our land to the implements, and soon found a double benefit,—first, in the use of the machines, and then in the improved condition of our fields. So, too, when the steamer, with its gang of ploughs, or other implements of tillage, shall be brought to the perfection indicated, we can no longer afford to use our present kind of power, and must hasten to prepare our farms and change our mode of farming to receive its benefits. Our fields must be re-arranged in form and size, and with regard to shape and surface, as it shall require. Useless trees, stumps and fast stones, whether in the surface or subsoil, must be removed, sloughs filled and open ditches made into covered drains; lands, too wet and soft to support the machine, must be solidified by underdraining. The miserable, unsightly, costly and useless boundary fences between small farms must be removed, and their tillage so arranged that the steamer may line out its furrows from farm to farm, and perfectly accommodate their owners. Where business is so limited as not to justify private

ownership, the power may become joint property, or the tillage of a neighborhood may, by agreement, be performed by one owner, who shall engage in it as a business. All this would not be a greater change than we have seen take place in our farm-operations within the last twenty years. It seems but yesterday that we were struggling, and human muscles driven to their utmost strength, that with scythe, sickle, cradle, and hand-fork and rake, we might secure our summer crops. To-day, seated on light, easy-moving and riding, but most effective working machinery, we drive across our fields in comfort and pleasure, and garner them with a rapidity and perfection unknown and not conceived of in the olden time. Now, the general progress of the age, the interest of agriculture and of mankind demand that the sweating, jaded horse shall be unhitched from the plough and other heavy draughts of the farm, and the tireless, nerveless engine shall be harnessed in his place, and made to contribute all its power to diminish labor and increase the food-products of the soil.

LEVI STOCKBRIDGE.
O. B. HADWEN.
FARWELL F. FAY.

After discussion, the essay was laid over under the rule to come up for a second reading.

Voted, To approve the action of the Middlesex North Agricultural Society in uniting its exhibition with that of the New England Agricultural Society, and that it shall not prejudice its right to receive the bounty of the State.

Voted, To appoint a Committee of three to consider and report to this Board with reference to applying to the legislature for further protection against frauds in fertilizers. Messrs. Clark, Saltonstall and Stone.

Mr. Saltonstall, Chairman of the Examining Committee, submitted the following Report on the Massachusetts Agricultural College :—

REPORT OF THE EXAMINING COMMITTEE OF THE BOARD OF AGRICULTURE OVERSEERS OF THE COLLEGE.

Your Committee appointed to visit the Agricultural College have the honor to report as follows:—

The Chairman attended the examinations in April and November, the other members of the Committee at Commencement, and were much pleased with the general appearance of the college, the efficiency and earnestness of its officers and professors, and with the apparent zeal and interest of most of the young men who are availing themselves of the great advantages there presented them.

It is truly wonderful that in so short a time this admirable institution should have assumed such proportions. Only incorporated in 1863, receiving its first class late in 1867, it now stands in the front rank of agricultural colleges in this country, an object of reasonable pride to the Commonwealth.

The buildings are substantial and well arranged, the dormitories most comfortable, the lecture-rooms and drill-rooms large and airy. The new barn, well filled with several varieties of pure-bred stock, and with the products of the farm presents a tempting place of resort to the students at all times.

The classes in April were examined in botany, moral philosophy, agricultural chemistry, mathematics, English literature and practical farming; at Commencement *(inter alia)*, in the relation of science to practice in agriculture, renovation of exhausted soils, rotation of crops, manures, stock-husbandry and in agriculture as a business pursuit; in November, in road and railroad construction, zoölogy, use of manures, chemistry, and military drill; all of which were creditable alike to professors and students, the relations between whom seem to be of the most agreeable nature.

The military exercises, under the careful instruction of Lieutenant Merrill, U. S. A., were excellent, and are apparently viewed by the students more as a recreation than a task. The college is fortunate in having such an officer detailed by government for this department. This officer also

inspects all the dormitories every week, making the most careful and minute examination as to the orderly and cleanly habits of the young men.

The farm, under the careful and intelligent management of Mr. Dillon, is constantly improving, and shows, for the last year, quite satisfactory results, though it has of course to contend with many and quite necessary obstacles to the most profitable returns. The necessity of carrying out experiments in manures, in rotations, in various machinery and modes of cultivation is naturally at times quite unremunerative. The labor of the students is, though well paid, not so economical as the steady employment of hands skilled in the performance of the various farm-work. Some of the experiments with new machinery have however proved very satisfactory, especially the Dibble machine, imported from Germany, which sows eight rows at a passage; and the *Rüben Hack* machine or root-cultivator, also a German invention, which cultivates five rows at a passage. The experiment of planting and cultivating corn with these machines without hand labor was very successful.

Hay was in a great measure cut and housed the same day, and is sweet and well-colored. When it is considered that labor must be laid out in beautifying the farm, and in fitting it for its various purposes of a stock-raising and seed-growing farm; a nursery, a botanical garden, conservatory, arboretum; apple, pear and peach orchard; vineyard, market-garden, experimental station, veterinary hospital, and a parade-ground; and all this to be performed as economically as possible, and at the same time to make the works subserve the two important offices of furnishing employment and practical instruction to the students,* it is quite astonishing that the crops on the farm are so good and the stock so well cared for.

The conservatory is a beautiful and instructive feature of the college. Like all other blessings, however, it eminently suggests the great advantage of a large increase of glass, this being now a department which might be made very remunerative to the college, and at the same time of great benefit to the students.

* Answers by J. C. Dillon to interrogatories propounded by the Commissioner of Agriculture.

The laboratory, the mathematical and philosophical apparatus, are excellent, and under the excellent instruction of the learned professors of chemistry and mathematics render attractive as well as comprehensible the various departments which they serve to illustrate.

This being founded as an *agricultural* college, where young men may acquire the best knowledge of farming and its kindred pursuits, in fact of all which modern science and experiment is capable of affording them, your Committee endeavored, by the most careful attention, to learn whether the college is pursuing such a course as was intended by the federal government as well as by the Commonwealth, and they can cheerfully and conscientiously bear witness to the truth of the affirmative.

The education which is here received is no more extended than ought to be borne away from such acollege, and it ought to fit a young man to carry on, profitably and pleasurably to himself, as well as with advantage to his neighbors, a farm for any purpose; to become an engineer, mechanic, superintendent, agricultural editor, and to pursue the various paths where a man may become useful to the agricultural community. He learns more or less of that manliness which is inspired by daily exercise as a soldier, as well as to defend his country in time of need,—an admirable feature of the institution and wisely required by the government.

The statistics of the occupations chosen by the graduates show that a large number have adopted agricultural pursuits as their permanent occupation. It cannot, of course, be expected that the whole or any certain proportion of the young men should adhere to a purpose which may have been seriously entertained by them on entering this college of becoming farmers. As character is developed by education, the tastes and feelings are greatly changed, and the paths pursued by them must necessarily diverge. If, however, each class turns out a reasonable number of well-educated scientific agriculturists, then may the college well be considered as fulfilling the intention of its foundation.

To the energy, zeal and fidelity of the president, with his able corps of professors, this pioneer work (as it is in America) owes its wonderful advancement. For though agricult-

ural schools and colleges abound in England and Germany, yet they can neither of them, for various reasons, serve as exact models for what is required in Massachusetts. Its future, in great measure depends on the support which it meets from the class of people for whose benefit it was directly intended.

It is now full, but is it never to expand into larger proportions? Let the Massachusetts farmers feel that interest, that pride, and give that support to this college which they ought, and it will be an honor to the Commonwealth and a blessing to her children.

LEVERETT SALTONSTALL,
S. B. PHINNEY,
A. J. BUCKLIN,
Committee.

The Report was accepted, when, at the request of Colonel Clark, it was—

Voted, That permission be given to print the report in connection with the report of the trustees of the college.

On motion of Mr. Saltonstall, it was—

Voted, That Prof. Charles A. Goessmann be appointed Agricultural Chemist to the State Board of Agriculture.

Adjourned.

THIRD DAY.

The Board met at 10 o'clock A. M., Mr. FEARING in the chair.

Present,—Messrs. Agassiz, Allis, Clark, Cole, Davis, Fearing, Graves, Goodale, Hadwen, Hawes, Hubbard, Hyde, Kellogg, Knowlton, Ladd, Leavitt, McElwain, Miles, Moore, Phinney, Root, Sargent, Sessions, Slade, Stone, Sturtevant, Wakefield and Wilder.

Mr. HUBBARD, for the Committee on Credentials, presented the following

REPORT.

The Committee on Credentials respectfully report that they have attended to the duty assigned them and find the following duly elected :—

Massachusetts,	CHARLES S. SARGENT.
Middlesex,	JOHN B. MOORE.
Worcester South-East,	WILLIAM KNOWLTON.
Hampshire, Franklin and Hampden,	ELNATHAN GRAVES.
Hampden,	HORACE M. SESSIONS.
Hampden East,	HORACE P. WAKEFIELD.
Berkshire,	ENSIGN H. KELLOGG.
Hoosac Valley,	JOHN M. COLE.
Housatonic,	HENRY S. GOODALE.
Bristol Central,	JOHN A. HAWES.
Hingham,	ALBERT FEARING.
Marshfield,	GEORGE M. BAKER.
Appointed by the Executive,	LOUIS AGASSIZ.

N. S. HUBBARD.

The report was accepted.

Mr. McElwain submitted a report as Delegate to the Franklin Society.

Mr. Slade, from the Committee appointed to revise the times of holding the various county fairs, recommended that the Norfolk Society begin on the last Thursday of September, the Bristol Central on the last Wednesday but two, and the Plymouth on the last Wednesday but one of September.

The report was accepted.

Voted, To appoint a Committee of three to nominate a list of Delegates to the exhibitions.

Messrs. Hadwen, Davis and Hubbard.

Mr. HUBBARD, Chairman of the Committee on that subject, submitted the following essay upon

THE RELATIVE VALUE OF FARMING AMONG THE OCCUPATIONS OF LIFE.

Were we to speak of the real value of farming among the occupations of life, it would be something like speaking of the real importance of the heart compared with other members of the body. The very foundation and prosperity of all other branches of industry depend almost entirely upon the prosperity of agriculture, and cannot thrive without it. If we take any branch of industry we shall trace it to the products of the soil for its foundation.

The retail dealer in cotton-goods, who grows rich in the traffic, goes back to the wholesale dealer, and he to the manu-

facturer, and so on to the dealer in the raw material, until we finally reach the cotton-fields for the foundation of all after-accumulations. And thus it is with the manufacturer and dealer in woollen goods. It reaches back to the farmer, who tends his flocks upon the hillsides and valleys, for the production of wool. And thus we find it in every branch of industry, traceable to the products of the soil; so that the question often forces itself upon us, Does the farmer get an equal share of the profits compared with the capital invested, and the amount of labor performed?

I sometimes think the various industries may be compared to the erection of a vast edifice. The foundation must be laid. Every stone is necessary, every timber, joist, board, nail, door, window, and all the ornamental part. But how many there are who are wishing for some one besides themselves to lay the foundation! They are willing to work on some other part, where the labor is less and the pay more, but do not like the foundation-work. They will do the carpenter-work, masonry, painting, or the manufacture of different varieties of furniture to be used. One will purchase of the farmer one variety of lumber, another will purchase another, and after going through the various processes, it is sold to the contractor, each getting a better profit than the farmer. And thus it is with the various kinds of labor till the edifice is completed, when the insurance agent steps in, and for the best profit will insure against loss by fire, which always proves good if losses are not too great.

I have spoken of the comparative value of farming in a former report; and this will be substantiated by a reference to the value of farm-products at that time, many of which were from fifty to one hundred and fifty per cent. higher than they have been for the past few years, when the cost of production was but a trifle more than at the present time. With this diminution of prices, and the cost of production remaining nearly the same, there has consequently been a large reduction in the profits of the farm. The tendency of this has been, and is, to deter young men from engaging in the business, and also, in many localities, to depreciate the value of farming-lands. The population of the State is regularly increasing, as well as the entire valuation. This increase of

wealth and population is confined almost exclusively to the cities and large towns, while in many localities, not only the farming population is decreasing, but the value of farming-lands. One reason for this diminution is the fact that since the introduction of machinery on the farm less help is needed, and another, that the income of the farm will not allow as high wages as other branches of industry. This seems conclusive evidence that farming is not considered on a par with other branches of business at the present time.

It is a common remark that farmers are in better condition now than they were thirty or forty years ago; that they have better houses, better barns and better herds of cattle; that families are better clothed and better educated. All this we believe to be true. And how has it been accomplished? We see from careful observation that families are supported from the wages now received by one man, and something saved besides. Now no one, I think, will claim that farmers are not as industrious and economical a class of citizens as there is in any community. Now, if labor alone will support a family, an income for the capital invested, if not more than two or three per cent., will constantly improve the condition of the farm. But the question recurs, If the farmer should put his labor by the side of the help employed, and transfer his capital employed in farming-operations to our savings banks, where six per cent. is paid, free from taxation, would he not accumulate faster? I am a farmer, and an advocate for the farming interests of Massachusetts, and hope for a re-action in their favor.

Young men in choosing a vocation will take positions where there is the best pay, with the least amount of labor, all other things being equal. These places are more numerous every year, with less competent young men to fill them, so that the farm does not get its share. If a mechanic is to be employed by the farmer, half the farms in the State do not give a daily income sufficient to pay the expense of one man. This is unfortunate for the farmer, and there needs a re-action to more nearly equalize, so that the attractions of the farm will be at least equal to other branches of industry.

I have examined the cheese report of the last year, or rather for the year 1871, and I find that some factories did not reach

two cents per quart for milk manufactured into cheese; and no factory reached two and a half cents. In the dairying sections this is nearly all the income of the farm. The hay is needed for winter food of the cows, and the grain raised is not sufficient for home consumption. If any beef is sold, the proceeds are needed to replace cows taken for that purpose. If any pork is made, the profits arising therefrom are very small.

I have spoken of the value of milk for cheese, but have omitted the whey. Of how much value this is it is difficult to determine definitely. In some cases factories have reported it to be quite valuable, by giving the cost of hogs and the grain fed to them on the one side, and the income from the pork on the other, giving all the gain to the whey; while in other cases, in different years, upon the same calculation, the whey has been more than worthless; so that it is not safe to place a high value upon it. Now, if the Massachusetts farmer in the dairy sections will take a careful inventory of all the capital invested, keep an exact account of his own labor, and all the labor employed on the farm for the year, with all the expenses attendant on the management of the farm on the one side, and all the sales, together with the support of the family, on the other, and when the balance is struck, if there is found more than the interest of the capital invested, then milk can be produced for less than two and a half ($2\frac{1}{2}$) cents per quart.

I am confident, from the best information I am able to obtain that a careful analysis of the whole matter would fail to give six per cent. interest on the capital invested. I have examined the cost of help at cheese-factories, and find it will require a dairy of at least twenty cows to bring an income sufficient to balance the account; and will require a less amount of help than the farm that will support the above number of cows. Thus on the one side labor alone is requisite, while on the other labor and capital are required. "But," says one, "would it not be better to sell the milk, and let the cheese be made farther from our markets?" I reply, that all the milk cannot be sold, as there is a greater supply than demand. I find, also, from one town in Worcester County, where a car was run daily to Boston for the transportation of milk, the price paid to the farmers for their milk, delivered at the car,

during the last summer, was one and one-fourth ($1\frac{1}{4}$) cents per pound, and as a quart of milk weighs but a small fraction over two pounds, the price would not much exceed two and a half cents.

But we are not confined to the dairy. Different localities are engaged in other branches of farming. In the vicinities of cities and large towns market-gardening is found to be the most profitable part of agriculture, and in many instances is found very remunerative. But even here there are sometimes failures, as the crop does not always pay the expense of its cultivation. In no branch of business can we calculate with less certainty than in the cultivation of the soil and the profits arising therefrom. We may know definitely what it costs in a given year; but we cannot from that deduce a rule which will hold good in succeeding years. Neither can any plan be laid down, that does not require intelligence and quick perceptions, to vary as circumstances shall require.

It is not safe to calculate that if any branch of business is constantly and steadily increasing, if it is affording good returns for the capital invested and the labor performed, that it is wise and safe to engage in it.

But the question recurs again. If there was no more labor on the farm, and the income was equal to that of other employments, we should expect a larger number to engage in the business. The truth is, too large a number, or rather per cent. of our young men withdraw from the farm to engage in other occupations. We find also almost invariably that those who speak in the highest terms of agriculture are those who do not get their income exclusively from the farm. Circumstances have required a change in the mode of farming, and many of the products of the soil are decreasing from year to year. I will mention but few. The potato-crop in 1850 was 3,585,384 bushels; in 1860, 3,205,517 bushels; and in 1870, 3,026,363 bushels. The manufacture of butter was, in 1860, 8,297,936 pounds; in 1870, 6,559,161 pounds. The manufacture of cheese was, in 1850, 7,088,142 pounds; in 1860, 5,294,090 pounds; in 1870, 2,245,873 pounds. This great decrease from 1860 to 1870 probably does not include the cheese made in factories, about thirty of which were erected during that decade, and which would have added

largely to the last amount. There is also a constantly increasing demand for milk.

Hay, which is the most valuable farm-product in Massachusetts, and which in 1865 was more than four times the value of any other agricultural product, to say nothing of the grass in pastures, was in 1860, 665,361 tons. In 1870, 597,455 tons. This decrease of the hay-crop in 1870 may be owing partly to the dry weather of that year. Thus it is with other products; while there are still others that have increased. Garden vegetables and fruit, also tobacco, are more extensively grown. The demand for milk is also increasing from year to year. I have no data by which to give the exact increase of the above products, but hope the statistics, which are required by law, and which will again be published in 1875, will give us the exact information of all the productive industry of the State. I have spoken thus far only of our agriculture, but will turn for a few moments to other branches of industry.

In the early settlement of the State agriculture was the leading employment. And not till 1787 was there any successful effort to build a cotton-factory. Two years later a company received a grant from the State of one thousand pounds, by the aid of which they succeeded in establishing themselves at Beverly. Another company was formed in Rhode Island in 1788. But as neither of them could get the desired machinery from Europe on account of their laws forbidding its introduction, and as there were no machinists in this country having the ability to manufacture such as was needed, but little progress was made. But in 1789 Samuel Slater came to this country with the needed machinery in his brain, and soon made arrangements for bringing it out. In 1793 he, with others, erected a small mill at Pawtucket with seventy spindles. Other mills were soon erected. In 1813 one was built at Waltham; and in 1822 the first cotton-mill was erected at Lowell, now the city of spindles. And so rapid has been the progress in the State that in 1865 the manufacture of cotton goods, including muslin de laines (part of which is wool), amounted to $81,231,542; this one department being more than all the agricultural products, including horses, oxen, cows, sheep and wool, beef, pork, mutton,

veal and poultry. We see that this department is making rapid strides.

Our woollen manufactories, in 1865, amounted to the nice little sum of $48,430,671, and that of boots and shoes to $52,-915,243. Clothing $17,743,894. And thus it is through all the different branches of industry in smaller sums. Should we not expect that with this drawing away from agriculture, there would be a better market and better prices? But a direct communication with broader fields and a richer soil supplies this demand. Said Andrew Jackson, "Withdraw from agriculture, and employ in manufactures, and you give the farmers a larger and better market." This he said before the East and West were brought into such close proximity. The population of Massachusetts is steadily increasing, and I have spoken of the rapid progress in various branches of industry, and of the decline in agricultural products; also of the decrease of that portion of her population. Still there are many redeeming features.

In proportion to the whole population distinguished success falls to the lot of but few. And in many cases where great success is attained, it is at the expense of those purer and nobler qualities which ought to possess the man. Massachusetts agriculture will never allow of immense gains. There are no Vanderbilts or Stewarts. But still it has its advantages and attractions which are worthy of notice.

I have spoken more particularly of the different branches of industry in a pecuniary point of view, while there is a moral point that needs consideration. The young man upon the farm, isolated as it were, is not so constantly coming in contact with the haunts of vice and with places where temptation lurks at every corner, but is in constant contact with the works of nature, which tend to lead his thoughts through them up to nature's God. The farmer is constantly in contact with his flocks and herds, and is admiring his growing crops and trees which his own hands have planted. He also partakes of his crops fresh from his own garden, orchard or field, feeling that he has a right to be partaker first of the fruits of his own labor. And as he is constantly improving his surroundings, as the thrifty farmer will do, he is endearing the old home to himself and family, so that those members

who resort to the cities and large towns have a delight and pleasure in spending a few weeks in the heat of summer at the old homestead nowhere else to be found.

How many there are in the professional and mercantile life who are looking forward to the time when they shall have accumulated sufficient to retire to rural pursuits and a home in the country, where they can make their "last days their best days," and enjoy the fruit their own hands have planted! But whoever heard of a farmer who was looking forward to the time when he should retire to professional or mercantile life?

It is a mistaken idea that the farm can forever be deserted or neglected. And whoever can do anything to encourage agricultural prosperity or promote its interests, is also promoting the interests of all branches of industry and is a benefactor to the world. Let us, as farmers, if we cannot boast of our Astors or Girards, feel that we are comparatively independent; that we are not troubled with many of the perplexities of the business-man, and that all are to a great extent dependent on us for their daily bread.

N. S. Hubbard.
A. P. Slade.
J. N. Sturtevant.

The essay led to some discussion, after which it was laid over under the rule.

President Clark, from the Committee to consider and report what action should be taken in regard to securing greater protection against frauds in commercial fertilizers, submitted a form of memorial to the legislature.

Voted, That a committee of three, of which Prof. Goessmann shall be one, be appointed to appear before the committee of the legislature. Messrs. Clark, Goessmann and the Secretary.

Col. Stone reported on behalf of the committee on the time and place of holding the country meeting of the Board, that it be held at Westfield on the 2d, 3d and 4th of December.

This led to a discussion of some length, when it was

Voted, To substitute Fitchburg in place of Westfield, when the report was adopted.

Voted, To appoint delegates to attend the session of the American Pomological Society to be held in Boston in September next. Messrs. Agassiz, Fearing, Flint, Hadwen, Knowlton, Slade and Stone.

The Examining Committee of the Massachusetts Agricultural College was constituted by the appointment of Messrs. Wakefield, Kellogg and Moore.

Voted, That the annual meeting of the Board begin hereafter on the Tuesday preceding the first Wednesday of February.

The Board then adjourned.

FOURTH DAY.

The Board met at 10 o'clock, A. M., Hon. Marshall P. WILDER in the chair.

Present,—Messrs. Agassiz, Allis, Baker, Clark, Fay, Fearing, Goodale, Graves, Hadwen, Hawes, Hubbard, Hyde, Ladd, Leavitt, Loring, McElwain, Miles, Moore, Phinney, Root, Sargent, Sessions, Slade, Stone, Sturtevant, Wakefield and Wilder.

Messrs. Moore, Fearing and the Secretary were appointed a Committee on Printing.

Mr. HADWEN from the committee appointed to consider and report upon the assignment of delegates, submitted the following:—

Essex,	ENSIGN H. KELLOGG.
Middlesex,	LOUIS AGASSIZ.
Middlesex South,	JOHN A. HAWES.
Middlesex North,	HORACE P. WAKEFIELD.
Worcester,	MARSHALL P. WILDER.
Worcester West,	JONATHAN LADD.
Worcester North,	THOMAS L. ALLIS.
Worcester North-West,	JOHN M. COLE.
Worcester South,	ELIPHALET STONE.
Worcester South-East,	HORACE M. SESSIONS.
Hampshire, Franklin and Hampden,	CHARLES G. DAVIS.
Hampshire,	ANDREW M. MYRICK.
Highland,	LEVI STOCKBRIDGE.

Hampden,	George B. Loring.
Hampden East,	William Knowlton.
Union,	Avery P. Slade.
Franklin,	S. B. Phinney.
Deerfield Valley,	Newton S. Hubbard.
Berkshire,	Eugene T. Miles.
Housatonic,	Joseph N. Sturtevant.
Hoosac Valley,	Thomas P. Root.
Norfolk,	George M. Baker.
Bristol,	O. B. Hadwen.
Bristol Central,	Farwell F. Fay.
Plymouth,	Elnathan Graves.
Hingham,	James F. C. Hyde.
Marshfield,	Jonathan McElwain.
Barnstable,	Charles S. Sargent.
Nantucket,	Henry S. Goodale.
Martha's Vineyard,	Roger H. Leavitt.

The Report was accepted, and the delegates appointed accordingly.

Mr. Hubbard, from the committee appointed to consider and report a list of subjects, with the committees to whom they should be referred, submitted the following report:—

Fruit Culture.—Messrs, Wilder, Hyde and Sessions.

Field and Garden Seeds.—Messrs. Moore, Stone and Hawes.

Forestry.—Messrs. Clark, Hawes and Kellogg.

The Essentials of an Agricultural Experiment.—Messrs. Sturtevant, Slade and Wakefield.

Agricultural Improvements—From what source do they come?—Messrs. Stockbridge, Root and Miles.

Commercial Fertilizers—Their character and office in increasing the fertility of the farm.—Messrs Goodale, Hadwen and Cole.

The Brain and Mental Faculties of Domesticated Animals.—Messrs. Agassiz, Loring and Phinney.

Other subjects, upon which any member of the Board interested in them was invited to write, were suggested as follows:—

Our Agricultural Societies.—On Fallacious Agricultural Opinions.—What System of Agricultural Statistical Returns is best calculated to exhibit the true condition of Agriculture?—The Influence of Manufactures on Agriculture.

The Report was adopted.

37

Voted, That the Museum of Comparative Zoölogy has secured a place in the scientific world alike honorable and useful, and the State Board of Agriculture most earnestly urge upon the legislature a liberal policy for its support as an important branch of education in the Commonwealth.

The reports of delegates to the county societies were then read by their titles and adopted. The several essays were also read a second time and adopted.

Mr. Hubbard then submitted the following:—

Whereas, In the opinion of the State Board of Agriculture it is of the highest importance that the agricultural products of the Commonwealth should be placed in the best markets at the lowest rates of transportation, without which increased production is of secondary value and increased expenditure of labor and capital on the farm measurably unremunerative; it is

Resolved, That a committee of three members be appointed by this Board to aid the Secretary in memorializing the legislature to secure, if possible, a lower tariff of freight on our railroads for agricultural products, or at least to place them on rates proportionately uniform with those denominated long or through freights.

The Committee appointed consisted of Messrs. John B. Moore, of Concord, Eliphalet Stone, of Dedham, and Avery P. Slade, of Somerset.

The Committee on Meetings was constituted by the appointment of Messrs. Miles, Fay, Hadwen, Sturtevant and the Secretary.

Voted, To meet at the Massachusetts Agricultural College, Amherst, on the 15th and 16th of July.

Voted, That the Secretary be requested to notify the various Agricultural Societies that the rule in regard to awarding premiums and gratuities upon grade and native bulls is still in force.

Voted, That in the opinion of this Board it is very desirable that the various Agricultural Societies in this Commonwealth maintain scholarships at the Agricultural College and select the young men who are to receive the benefit of the

same by competitive examination, and so far as practicable, from those who intend to become farmers or gardeners.

Voted, To refer all unfinished business to the Committee on Printing, with full power.

Adjourned.

THE STRUCTURE AND GROWTH OF DOMESTICATED ANIMALS.

LECTURE BY PROFESSOR LOUIS AGASSIZ.*

Ladies and Gentlemen:—The subject announced in the programme for this evening's lecture is "The Structure and Growth of Domesticated Animals." It would take a year's course to do justice to the whole subject, and I had therefore to choose a portion of it, and especially such a part as may give you an idea of the difficulties of investigating some of the topics which are, perhaps, of the greatest importance in practical life. It is often expected that science will furnish all the information wanted at a given moment, but unfortunately science is not always ready. My object is to show that you must have knowledge before you can apply it, and that knowledge is not always to be had for the asking. There is not always that information on hand which may be needed even for the most useful purposes; and in order to allay the impatience which is sometimes manifested in respect to the want of usefulness on the part of scientific men and their ability to enter into the arena of practical life, I wish to show you how difficult it is to handle some of the subjects, and I have chosen one respecting which, of course, a farming community supposes that science can furnish all the information wanted.

Concerning the anatomy of our domesticated animals there is a great deal known; enough to give a good idea of the peculiarities of the full-grown animals of the different kinds which we raise to use for various purposes. Concerning the functions of their organs, there is also a great deal known,

* Delivered before the State Board at Barre, December 3d. The necessary delay in the preparation of illustrations prevented its insertion in the proceedings of the Barre meeting, on a previous page.

which is of value and service to guide us in our treatment of them. Nobody expects to treat a pig as he treats a horse; and the difference in our management of two such animals is determined by what we know of their structure, by what we know of the functions or the play of their characteristic organs; but there is one topic about which the farmer would like to know more, and that is in reference to breeding; and especially such points in the process of breeding as would enable him to do certain things which would add greatly to the value of our stock. If it were known how to raise male animals in places where it is desirable to have them in larger numbers, if it were known how to raise heifers in those regions where dairy farming is largely carried on, imagine what an advantage it would be to be able to determine beforehand the sex of the animals to be bred. Unfortunately, we do not know enough to-day to guide us in that direction, and yet I have not the remotest doubt that the time is coming when we shall be able to bring forth what we want, as we have been able to produce certain peculiar modifications of the various kinds of domesticated animals to suit our purposes,—when we want beef rather than milk, when we want strength rather than delicacy of structure. Now, how shall we get at it? We have not the information. You may consult the men of science, the most learned men of the day in every part of the world, and they will say, "Upon these topics we have no satisfactory knowledge whatsoever." It is to be reached only by studying the various functions connected with the process of breeding, by studying especially the earlier stages of the growth of animals with which we are familiar, and studying them with reference to that point. Upon that topic I will make a few statements concerning the facts with which I am familiar.

It is not long since all animals were divided into two classes with reference to their breeding. Some were called oviparous—that is, egg-laying animals, which multiply by laying eggs, out of which a young animal is eventually evolved; the others were called viviparous,—such as bring forth living young, after a more or less protracted gestation; and these two classes of animals were supposed to be widely different one from another, both in structure and in mode of

reproduction; but less than fifty years ago, a German physiologist, Karl Ernst von Baer, one of the ablest investigators of our century, made the astounding discovery that all animals bring forth eggs that may not be distinguished from one another at a certain stage; that all our cattle, all our domesticated animals, all the beasts of the forest, as well as all the birds on earth, produce eggs similar to one another. This seems a very extraordinary statement, yet perhaps I shall be able to make you familiar with the fact, and to make you understand it as fully as you know that your hens lay eggs. But the eggs of a great many animals most useful to us, and of those about which we would like to know most, have not been studied microscopically. I have devoted a great deal of my life to similar topics, and I have never yet seen the egg of a mare; I have never yet seen the egg of a cow; I have never yet seen the egg of a pig; yet I believe that these animals bring forth eggs as much as the animals that have been investigated with reference to that point. A sufficient number of quadrupeds have been studied to leave no doubt that all quadrupeds produce eggs as well as birds, as well as all other animals, without exception. One of the ablest physiologists of our time, Professor Bischoff, of Munich, has devoted over twenty years of his life to the study of a few of these animals, and the results of his investigations are embodied in a volume of many hundreds of pages, with a large number of plates, representing the history of only four species of quadrupeds. One is the rabbit, another is the dog, a third is the guinea-pig, and the fourth a species of deer which is common in the forests of Europe,—the roebuck; and the history of these animals, as presented in this volume, covers only the very earliest period of gestation,—and mainly that portion of their history embraced during the first days of gestation, during the time when the egg of these animals is transformed into a germ which grows to be an animal like the parent. Now, unless we can have a similar history of any one of our more valuable domesticated animals, as of the horse, or of the cow, we cannot expect to know how to influence their reproduction. This is the very foundation of all knowledge in that direction. What will be necessary for that? When these investigations began they were made upon animals which could be

secured at the lowest price; they were begun with the hen. Two young German physiologists, Pander and D'Alton, under the guidance of Professor Döllinger, began that study, and, in order to ascertain how the chick is formed,—not how the chick grows in the egg, but how it is formed during the first hours after the sitting of the hen upon the egg has begun,—they opened three thousand eggs. Now, why is it that we have not yet such knowledge of the horse? Because there are not three thousand mares to be sacrificed to study their development; and unless some means are found by which something of the kind can be done, we cannot have the beginning of the history of that one animal; unless, perhaps, with the greater knowledge we now possess and long acquired skill, a smaller number of individuals may suffice; but not until hundreds and hundreds of animals are sacrificed for that purpose, under proper conditions, can we have the first fact concerning their history. And if you find in physiological text-books this subject treated as if it were entirely known, it is simply because the data in reference to the animals, the physiology of which is given in our text-books, are borrowed from the four animals carefully studied by Bischoff, and not from any particular knowledge obtained from the domesticated animals themselves. When, in our human physiology the embryology of the human race is presented, it is largely illustrated by conditions which have been studied from the rabbit, the dog, the guinea-pig and the roebuck. Direct observations are so few that they are hardly worth mentioning. A few cases of suicide have furnished the only information which is on record concerning the first condition of the human being.

And now I propose to show you what an egg is, and then to satisfy you that all animals produce such parts as deserve the name of egg.

A hen's egg, surrounded by its shell, which is calcareous, is lined on the interior by a double membrane. A skin extends over the whole internal surface, and that skin is double; and in one part of the shell it recedes from the shell and leaves an open space, which is the air-chamber of the egg. These are only protections of the egg, and are formed last upon it. In the interior of the egg we have a round ball

of yolk which is suspended in the egg by two cords of somewhat harder albumen than that which surrounds the yolk. These two cords keep the yolk so suspended in the egg that whatever position you give the egg, certain parts always remain uppermost. You may open any number of eggs and you will always find that a little white speck stares you in the face. You may turn the egg as you please, but that little speck will always be uppermost. This is owing to the fact that the yolk is heavier in one portion and lighter in another and that it may swing upon the two strings of albumen by which it is suspended. This speck, called blastoderm by embryologists, is the part from which the young chick is developed when the egg is brought under proper conditions of temperature, &c.

As to the albumen, or white, it is not one mass; it consists of a number of layers; and when you boil an egg so that the whole is hardened, it is easy to see that it peels off in these layers, which are deposited one after another. Now such an egg has a history. It does not begin to be an egg of that size; it does not begin with having a shell; it does not begin with having these membranes within the shell; it does not begin with having the white around the yolk. There is a time when the egg has neither shell, nor these membranes, nor the white, but when the whole egg is yolk; and you may find such eggs in the organ called the ovary, in which the eggs are produced. If we look carefully at the ovary of the hen, we find that it contains a variety of eggs. It has eggs which have attained to their full size—they are about the size of a small walnut—it may contain a certain number of these—but by the side of these large yolks there are smaller yolks of various dimensions, and if you will examine minutely, you will soon see that there are those, which, at the distance you are from me, you could not see at all, even if I represented them magnified a great many times; and you gradually, by learning to watch more and more closely, detect among this mass of eggs which are readily visible, others which are less and less distinct to the eye; and if you take a magnifying glass, you find that there are others which had escaped your eye when you had no magnifying power to help you; and, if you use higher and higher power, you begin to find that there are more and

more of these eggs, which loom up to your eye in proportion as you use a higher power of the microscope. It is like the starry heavens, where you have stars of first, second, fourth and tenth magnitude, some of which are visible to the naked eye, and others only through the telescopes of our observatories. Yet all these small specks in the ovary, invisible to the naked eye, are *bona fide* eggs. As soon as one of the full-grown yolks drops, to be taken up through the oviduct, and to be surrounded by albumen, and then by a shell, another grows larger, and when all those which are at any moment of full size have been laid, they are followed by another crop, and crop after crop comes to the surface of the organ, ready to be laid in succession. If you watch their growth, it is easy to see that each one passes into the condition of the eggs higher in size by a process of increase which is similar to the process by which a young animal grows to acquire the dimensions of an adult. Nobody now doubts that these small granules scattered through the ovary are really eggs in their incipient condition.

How do they look when examined under the microscope,—say under a microscope magnifying two hundred and fifty times the diameter,—an egg, therefore, which could not be seen by any human eye? You magnify it, as I have said, two hundred and fifty times, and you will see that that egg is a sphere, which you may, with the microscope, magnify to look as large as a full-grown yolk. It is then perfectly transparent, as if it were full of a uniform fluid, like water; but at some places on the side it has a little vesicle, a little bag, which is also transparent, and may only be seen under skilful management; in this again still another which appears like a small dot. Now, you examine an egg a little larger than that, and you will perceive that in it the fluid mass is obscured slightly by small dots. If you apply the highest power of the microscope to these dots, you very soon find that they are not solid granules, but that they are hollow vesicles which, in their turn, produce other granules within themselves, so that the growth of an egg is in fact the enlargement of little granule-like masses of animal substance, which are transformed into bag-like bodies within which the same process is repeated over and over again. These little gran-

ules inside, as the whole egg grows larger, burst and scatter their contents throughout it; and the egg, from perfectly white, becomes slightly tinged with yellow, and finally grows more and more opaque; and, when the yolk has acquired its full size and is ready to drop, it is really an opaque mass, but consisting throughout of these minute granules.

Now let us take the ovary of the rabbit, the guinea-pig, or any other quadruped, and examine its contents, and we see eggs exactly like these young eggs of the hen; so similar to them, that the most skilful observer is incapable of distinguishing the one from the other,—the egg of a rabbit from that of a hen. Of course they do not remain in that condition. There is this peculiarity: that the egg of a quadruped remains small, and while retaining these small dimensions undergoes of itself changes by which the germ is developed in time; while, on the contrary, the egg of a bird grows large; even before it has its shell, its yolk becomes very large, and it is surrounded by those auxiliary means of protection necessary for an egg which is to be cast before the germ is formed; while the fecundated eggs of mammalia are not cast, and the young undergo their development in the egg while the latter is still retained by the parent. And so it has been proved by Baer, that there is no difference whatsoever between so-called viviparous and oviparous animals, but that all produce eggs which have the same identical structure, and which differ from one another only by their various capacities, by the various proportions which they attain, and by the various ways in which the germ is developed in them.

One more word to satisfy you that this is the case in all animals. Eggs of the larger birds have been observed as I have said, and it needs not to be repeated that in every species in which the observation has been carried on, it has been found that the ovarian egg,—that is, the egg prior to its being laid,—has the small dimensions and the peculiar structure characteristic of all ovarian eggs in their earliest condition. This is also the case with reptiles. Our little turtles lay eggs of considerable dimensions in comparison with their size; but examine their ovary, and you will find that there are contained in that organ eggs of all possible dimensions, as in the bird, and that when young these eggs do not differ

from the egg of the quadruped. And so it is with the fish, whatever be the kind of fish. I have examined many sharks and skates, as well as many of our salmon and trout, and our various kinds of suckers and cod-fish, and I know that all these different kinds of fish produce similar ovarian eggs. Some of them lay them early, and lay eggs which are at once recognized as eggs, and others retain their eggs until the young are fully developed and they bring forth then, like the quadruped, living young; so that they exhibit within the limits of one and the same class differences similar to those which we observe among different classes in the higher animals. And if we pass from the class of fishes to the lower types ofthe animal kingdom,—to insects, for instance, crustacea, and worms,—we find everywhere the same process. Even the parasitic intestinal worms are now known to be produced by eggs, and eggs which are transferred by various processes from one animal to another, sometimes with their food or drink, and thus become again parasitic in succeeding generations. The same thing has been observed among the various kinds of molluscs,—the cuttle-fish and periwinkles, the oysters and mussels, for all these produce eggs; and when the eggs are examined, at the proper time, and in a proper manner, they exhibit exactly the same structure as those of the higher classes; and we may go down to the very lowest class of animals—the sea-urchins, the star-fish, the jelly-fish, or even the corals or polyps, and there again eggs are found, and eggs which in no way differ from those of the higher animals.

From such statements, which cover now such extensive ground, it might be inferred that to know one is equal to knowing all. By no means; but enough has been done to show us that every one has its peculiarities, every one has its own mode of development, and in every one there are peculiar processes which make the generalization only true in the most comprehensive form of expression, and no longer true in the details of the farther development. So that all our knowledge of the process of reproduction in one species of animals, may not give us an answer when we would inquire into the corresponding process in another animal. Thus you see the necessity of repeating for those animals, the

breeding of which we would desire to influence, all those observations which have been made upon a few.

I should like presently to make some remarks as to the kind of training necessary for this, that you may not imagine that the first enthusiast can go to work and do it. It requires a long training to be prepared to look at an egg, to be prepared to see how it grows; but before I make any such remarks, I would say a few words more concerning the formation of the germ, so that you may see what an interesting field of observation is now open to the student; *open*, not yet *cultivated;* by no means cultivated to the extent desirable in order to make the knowledge in any way useful in practical life. There is that condition necessary to all knowledge, that it should be acquired, not only in its general features, in order to be useful, but that it should be brought to a point where it shall be really applicable to any practical purpose; and a great deal of the difficulty in scientific investigation arises from the fact, that while it is easy to study, to a certain extent, it is not always easy to carry our knowledge to the point where its application becomes easy or even practicable. And I would say, to exonerate science from its failure to make itself more generally popular and practical, that the mental qualities required for investigation are not the same as the qualities required for practical application. You know too much of practical life to need to be told that the importers who bring to your manufacturing establishments the raw materials are not those who make the cloth for your clothes; or that those who import the raw materials with which all the various manufactures are produced are not likely to be themselves manufacturers; and the ability of the one excludes very often the ability of the other. In scientific matters this is perhaps more extensively the case than in practical pursuits, so that a class of men must be educated who will take up knowledge where the scientific man leaves it, and carry it where the man of business, or the practical man, requires it. I could mention many a case in which scientific men have injured themselves in their attempts to derive profit from their scientific work. That will happen again and again when scientific men enter into the arena of practical life. You must allow them to work in the field for which they were

prepared, and accept from them what they can give. I claim that as due to science, and I think the sooner the community understands it the sooner will all have the benefit of what science can produce and cease to ask the impossible from scientific men.

In this first presentation of the subject of embryology I shall not be able to give the whole history of the formation of a new being, but only so much of it as will satisfy you that our higher animals produce eggs like birds and the lower classes;

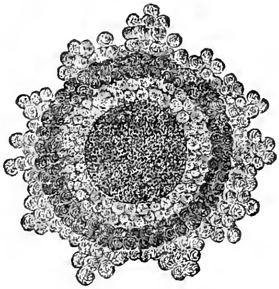


Fig. 1.
Ovarian egg of dog. Copied from Bischoff's embryology of the dog. Magnified 100 diameters.

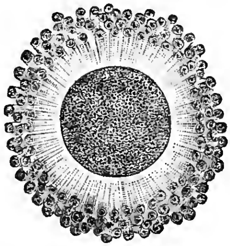


Fig. 2.
Another ovarian egg of dog, from a female in heat. Copied from Bischoff. Magnified 100 times.

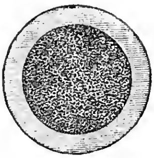


Fig. 3.
Ovarian egg of dog, freed of the cells which surround the zona pellucida in figs. 1 and 2. Copied from Bischoff. Magnified 100 diameters.

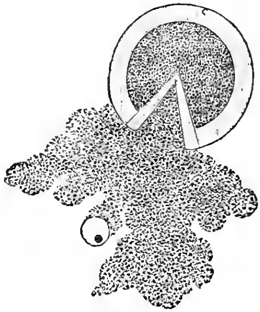


Fig. 4.
The same ovarian egg as that represented in fig. 3, cut open with a sharp needle. The mass escaping is *yolk*, with the transparent *germinative vesicle*, in which the *germinative dot* is visible. Copied from Bischoff. Magnified 100 times.

but with this essential difference, that in mammalia the fecundated egg is not cast or laid, but undergoes all its changes within the maternal body until the living young is dropped. Here are several figures of ovarian eggs of the dog, rabbit and human female, which may easily be compared with the eggs seen in the ovary of a hen. Figures 1, 2, 3, 4, 5, 6, 7 and 8 are such ovarian eggs.

Figs. 1, 2 and 5, 3 and 4, 6 and 7 show that the eggs of different mammalia, such as rabbits and dogs, resemble one another as much as the eggs of different species of birds belonging to different orders of this class.

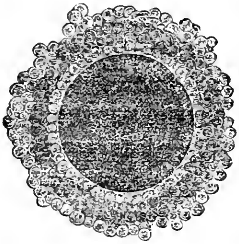


Fig. 5.

Ovarian egg of rabbit. Copied from Bischoff's embryology of the rabbit. Magnified 125 diameters.

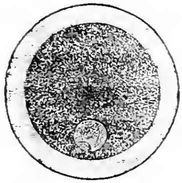


Fig. 6.

Ovarian egg of rabbit, freed of the cells which surround the zona pellucida in fig. 5. Copied from Bischoff. Magnified 125 times. The *germinative vesicle* shines through the *yolk* as a light spot.

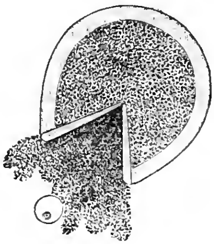


Fig. 7.

The same ovarian egg of the rabbit as in fig. 6, opened with a needle. The yolk, with the germinative vesicle and dot are flowing out. Copied from Bischoff. Magnified 125 times.

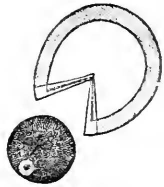


Fig. 8.

Ovarian egg of a human female, cut open. The yolk has escaped whole, and in it the germinative vesicle and germinative dot are seen as a lighter spot. Copied from Bischoff. Magnified 100 times. The resemblance to the eggs of the rabbit and dog represented in figs. 4 and 7, is very striking.

The formation of a germ in the egg begins by a very peculiar process, called "segmentation." It is unquestionably a manifestation of the internal life of the egg,—for an egg must be considered as a living body. "Segmentation" consists in this: Supposing we have here the egg of a dog, copied from Bischoff (fig. 9): the egg divides itself spontaneously into two halves (fig. 10), which are entirely independent of one another, and only retained together by the common envelope of the yolk. After that, each half divides

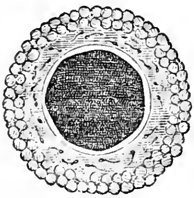


Fig. 9.

Fig. 10.

itself into two halves again, so that the yolk consists now of four masses of equal dimensions (fig. 11); and so the process goes on. Each quarter of the yolk divides itself again into halves, so that we next have eight such bodies (fig. 12); first, irregular in shape, but very soon assuming the form of spheres, which fill the cavity of the yolk-membrane. Eight balls, as it were, resulting by spontaneous division in the formation of a mul-

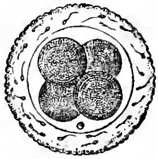


Fig. 11.

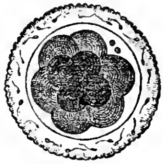


Fig. 12.

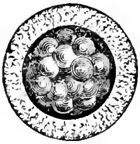


Fig. 13.

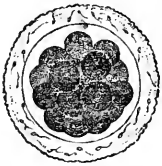


Fig. 14.

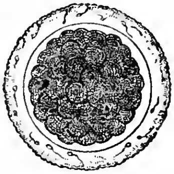


Fig. 15.

berry-like body as is represented in fig. 12; and this is divided again, until the eight have become sixteen (figs. 13 and 14), the sixteen thirty-two (fig. 15), the thirty-two sixty-four, and so on, until the whole of that mass is separated into little granules which are about as small as the primitive cells of which the yolk consisted (fig. 16). We have then a well-kneaded yolk-mass very similar to what the primitive cell was, only that, instead of simple yolk-cells, it now consists of an innumerable quantity of little spheres which have resulted from the spontaneous division of the whole into successively multiplied halves. There is, however, this difference,—that on one side of the egg there is, when this process is completed, a larger number of these small balls or globules than on the other, and they are more whitish. The difference arises from the fact that the balls multiply more on one side than on the other. In quadrupeds this process of self-division pervades the whole yolk, so that in the centre and on the periphery, and on all sides, it is evenly divided, except that on one side the spheres are somewhat smaller and also somewhat more whitish. In the yolk of a hen the process is widely different, and has been known only for a comparatively short time, for in the hen the process also takes place before the egg is

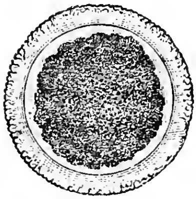


Fig. 16.

laid. In order to examine it, therefore, a hen must be killed and the egg must be observed during its passage through the oviduct, when on the surface of the yolk, and on the surface only, furrows are marked as if made with a nail. These furrows are multiplied crossways, and then crossways again, and this process is repeated until the whole surface is changed into these same globular bodies, already noticed in the rabbit and dog, but which in the hen extend only over a small part of the surface of the yolk. Now this small part of the surface of the yolk is that white speck which is seen at once when you open the shell of an egg; and from it the chicken is developed.

In fishes, there is still another process. Suppose we take the salmon. The first segmentation of the yolk consists in halving and quartering, and then the process of self-division goes on only in one-half, viz., in the upper half of the yolk, the lower half undergoing no change, so that you have at first only two spheres, one below and one above, then two in the upper part, then four in the upper part, then eight in the upper part, then sixteen in the upper part, the lower part remaining in its primitive condition, and the whole upper part finally being transformed into a body similar to what we have as a whole in the mammal, resting as it were on a cup of unaltered, unchanged yolk in the lower part. In the fish, it is this mulberry-like, segmented portion of the yolk which is changed into the germ, while the other half takes no part in the formation of the germ, but only feeds it, being in fact absorbed into it. The egg is actually a live being, only it is a live being which struggles into its structure by its own activity;—and in the formation of the organs it afterward possesses, the process of growth is not one of enlargement simply, but involves such changes as to transform a uniform mass into a variety of systems built of different tissues and endowed with special functions. In the chicken, two parallel swellings first arise along the middle line of the back, leaving a shallow furrow between themselves and the white disc spoken of above as a white speck, enlarges and spreads, so as to cover the whole surface of the yolk visible from above. If you look at this furrow in a section it will be something like an arch, open above. Gradually this furrow grows wider

at one end, with indentations right and left, and then the margins of the disc spread, and, folding downward, enclose more and more of the yolk, and the sides of the furrow thicken, so that represented in profile it will be no longer a shallow furrow, but something like a channel or tube.

At this stage the whole mass has still about the same consistency everywhere. It is like soft jelly and a little pulpy, but presently the two edges of the furrow come more closely together, and finally touch. Meanwhile the margins of the new being rise in a fold and enclose the central parts, forming a sac around the germ known as the amnios. The natural result of the closing of the upturned edges of the germ is the formation of a cavity, enclosed between these edges. That cavity now fills with a transparent fluid, and as it fills there appears something a little more substantial upon its sides and below it; the walls protecting the cavity become less transparent, or even slightly opaque; then the cavity widens sideways on its anterior part, and rises a little from the rest. In one word, this cavity forms the channel for the spinal marrow, and its front part the cavity for the brain, and the walls grow to be flesh and bone to form the dorsal spine. The upper part represents the axis of the skeleton, with the surrounding soft parts; the lateral parts form the ribs with their fleshy covering, and the animal thus closing over the yolk, we have the abdominal cavity. Now, it requires a little more enlargement, a little more change into different substances, to complete the formation of the new. The gelatinous substance outside the main axis is changed into a fibrous structure, which is muscle. The little opaque bodies in the axis and upon its sides absorb some earthy material contained in the primitive substance from which they have arisen, and thus bone is formed. The fluid in the upper cavity becomes a little more granular and more solid, and it is the brain and spinal marrow. The yolk is absorbed during the process of growth, but the wall within which it is contained is elongated and enlarged, and in consequence of further changes in the substance of that part of the yolk which is in immediate contact with the body-walls, the alimentary cavity is formed. You have, in fact, all the organs of the animal growing in the same way, by successive transformations of the homogeneous mass into all the

various tissues and organs which build up the animal in its perfect condition.

From the time the chick has reached the condition in which all its organs are fairly sketched, it simply grows larger and larger, and finally breaks through the shell. The skin has already become distinct from the muscles; the feathers begin to be formed, and all those parts with which you are familiar may readily be distinguished. You see now by what complicated process (the details of which I have considerably abridged) this is brought about.

I have given you but a meagre outline of the changes which take place in the formation of quadrupeds, birds, reptiles and fishes, though this may be sufficient to show that these processes must be studied in every animal independently.

The figures below, representing a fish in the egg, show at once how different the growth of these animals is from that of

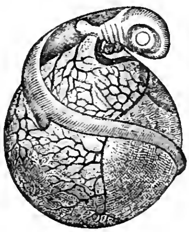


Fig. 17.
Young Blenny, copied from Rathke's Embryology of the Zoarces Viviparus. Magnified. Seen in profile from the right side.

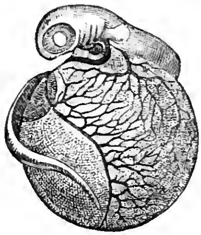


Fig. 18.
The same as fig. 17, seen in profile from the left side.

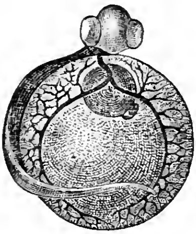


Fig. 19.
The same as figs 17 and 18, seen in front.

Fig. 20.
The same as figs 17, 18 and 19 before the egg-shell has burst.

the mammalia and birds. Here we have no amnios; the young fish remains free upon the surface of the yolk. The structure of the body, however, and the circulation of the blood upon the yolk, is strikingly similar to that of the dog, the chicken, or the little turtle. Compare in this respect the

figures of D'Alton with those of Bischoff and my own in the Embryology of our Terrapene.

Now, what are the conditions necessary for making these observations? A man must be practised, and not only practised, but fully skilled in the use of the microscope. He must know the structure of the animal in its adult condition so accurately, and so completely, that every difference in the structure of the younger animal will at once strike his eye. He must be able to make these comparisons without having specimens before him for comparison: he must have appropriated that knowledge to himself so completely that he may weigh the changes going on in the substance of the germ merely by the eye, and ascertain every change in so accurate a manner that he may record the facts in their true connection. And more than that, he must be able to prepare the conditions in which these germs will not be altered by being brought under the microscope. Try to bring an embryo, a young chick, in that early stage of growth, as you find it after a few days' incubation, under the microscope, and you are likely to find that you have reduced it to a shapeless mass. These objects cannot be handled like a piece of wood. They must be treated with a degree of delicacy which makes it impossible, for instance, for an observer to use any stimulant, even such as coffee and tea, or to eat heartily, or to exercise in any degree which may accelerate the pulse; otherwise his eye will be constantly thrown out of focus. Unless a man has himself under control to that extent, he cannot begin to make good observations. Not only must he have the knowledge necessary, not only must he have the practice necessary, not only must he have the instruments necessary—he must have his own organization so completely under control that he brings himself into that living relation with the object of his observations which alone makes it possible that they shall be accurate. It is not everybody who is willing or able to do this; and then he must carry on his observations by day and night, as the embryo is growing unceasingly, and unless he does continue his observations uninterruptedly, he may miss the most important steps in the progress of growth. Now before you find a man qualified to be an observer, you may have to wait a long while. It was just

so during our late war. We did not find the generals who knew how to command, the day of the first battle. It requires years to find a man capable of leading two hundred thousand men. In matters of scientific progress we need a great many students, and large schools, from which to pick out the man who is capable of making new discoveries, or simply accurate investigations; and have we these schools now? Is the number of our scientific students proportionate to the intellectual capacity of the nation? By no means; and until our system of popular education is radically changed, or so far changed, at least, that in all our schools instruction is given in those branches of science which train observers, you may not even have the knowledge necessary to carry on your practical pursuits, and still less the chances of making any real progress. These results can only be brought about by introducing into our schools that sort of instruction which prepares students to become observers, or at least, which gives the teacher an opportunity of ascertaining whether any of his pupils may be educated into an observer or not. Such schools we have not, such teachers we have not, or very few of them—half a dozen in Massachusetts is the sum-total of the men qualified to teach in that way; and the schools in which they may teach, the apparatus necessary for that instruction, we have not. We have to build them up, and we shall not have them before the community understands what are the conditions necessary for the acquisition of new knowledge which may improve the conditions of our success in the practical affairs of a civilized community.

You may ask what text-books you shall take to begin with. There are none that I would recommend. You cannot use the present text-books, for most of them are manufactured by people who know nothing or precious little of the subject about which they write. They are mere compilations, made for the market, by men who have no sort of knowledge of what should be the substance of a text-book; and, what is worse than that, our schools are crowded with so large a number of pupils that the teachers, even the very best of them, have to resort to all sorts of devices in order to keep alive. Instead of teaching, that is, instead of giving out of their knowledge and their substance something by which they can

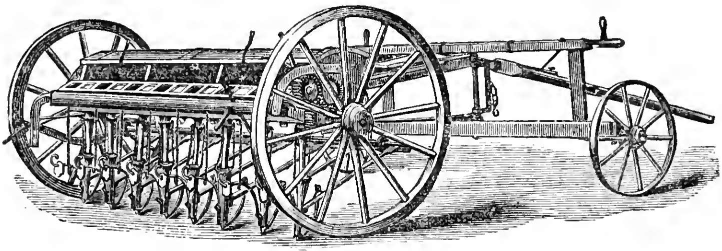
vivify the intellect of their pupils, they are forced by the pressure of numbers to direct their pupils to commit to memory some superannuated book, and make them recite things not worth knowing. So there we must begin. We must begin by relieving the teacher from a task to which no human being is equal; for it is impossible for any one person, at the same time, to teach eighty pupils well, in one and the same room. It is physically impossible. It is past endurance; and all those who have tried to do this kind of work, honestly and faithfully, have paid for the effort with the loss of health. And then there is another point. In order to get men capable of performing the difficult task of teaching, you must give greater inducements to able intellects to devote themselves to the task. The teacher's profession must not be the least remunerative of any profession in the community, as at present it is. Only those who by nature cannot help being teachers go into it, and their willingness to teach is misused by the community by giving them a pittance for their existence. So one more thing is needed: you must organize normal schools to educate teachers of natural history and science generally. You must not only determine that you will introduce these branches of knowledge into your schools, but you must prepare teachers for the task.

And here let me say a good word for the institution with which I am connected. I am trying, in the Museum at Cambridge, to educate such teachers; and most of those who are already abroad in the community are, I am happy to say, my pupils. Next year we shall make another effort in that direction, and organize a course of instruction on the seashore for all the teachers of the State who shall be willing to go, and charge them nothing. I hope this will come to pass next year. I had full confidence that it would, before the great calamity that has befallen Boston, because I knew that I could always depend upon the liberality of friends in that city to support any undertaking which seemed to promise valuable results. Whether in these dark days I shall be able to at once carry my plan to the extent which I had hoped, I do not know, but if I am able to carry it out, the instruction shall be this: All day long, those who shall come shall be taught how to observe. If they are not naturally able, naturally inclined towards

observation, it is better for them that they should then, and as soon as possible, go home. Those who shall show ability as observers shall be kept at it, and while learning how to observe, while taught by a corps of competent teachers, they shall make such collections themselves as will enable them to repeat, during the coming winter, to their classes at home, what they have learned, and in that way I hope a sufficient interest will be excited in the study of nature to induce the Commonwealth of Massachusetts to make the study of nature, —the study of nature generally, in all its branches,—a part of the common-school system of education.

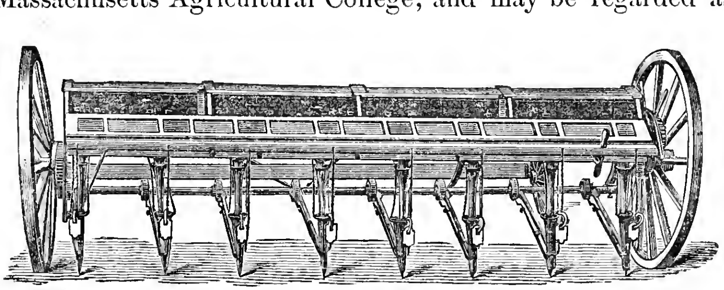
INTRODUCTION OF MACHINERY.

Among the efforts at improvement which have been made during the year, it is proper to notice the introduction of new machinery for the cultivation of roots, especially the beet-



The Germania Beet-Planter. Side View.

crop. These machines were imported from Germany by the Massachusetts Agricultural College, and may be regarded as

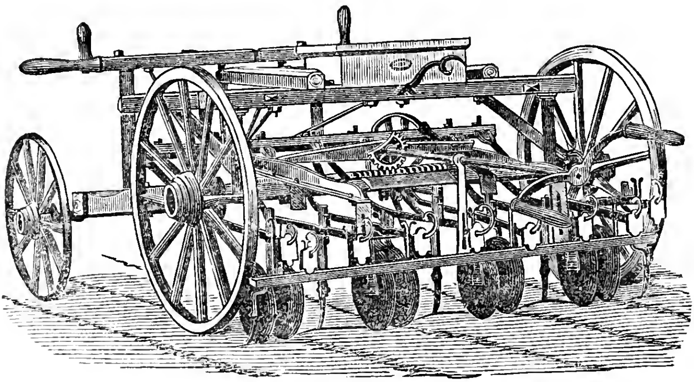


The Germania Beet-Planter. Rear View.

the latest attempts at improvement upon the modern English machines. The first is

The Germania Beet-Planter.

This machine weighs 1,350 pounds, is drawn by two horses, and plants eight rows eighteen inches apart. The seed is put into hoppers at the top and descends through apertures into

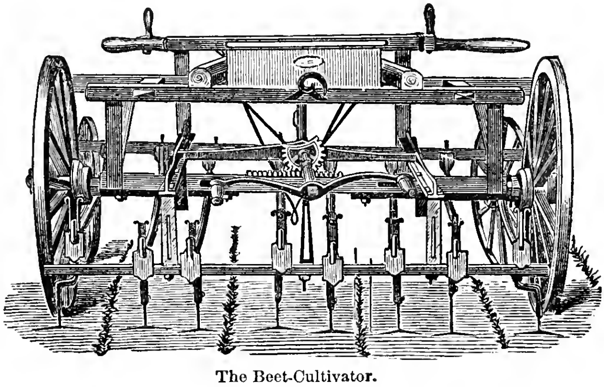


The Beet-Cultivator.

the body of the machine, where it is taken by little spoons and deposited through a seed-box in the drill. The machine will plant about twenty-five acres a day.

The Beet-Cultivator.

This machine cultivates five rows at each passage. Like the planter, it is drawn by two horses. It consists chiefly

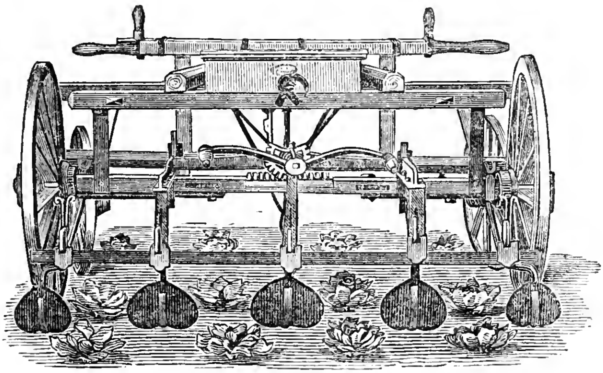


The Beet-Cultivator.

of five sets of hoes, or scuffle-hoes, suspended on a framework between the hind wheels. The frame can be moved

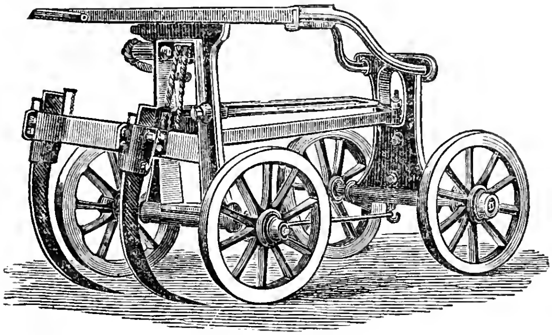
from side to side, raised to pass obstructions and for travelling on the road. There are attachments for protecting the young plants when needed.

For ordinary work, in killing weeds, the rear end of the machine has the appearance presented above, while for hilling around the plants at the last hoeing, there are attachments which give it the appearance presented in the following figure.



The Beet-Cultivator.

There is another machine called the Beet-Digger, which appears in the following cut.



The Beet-Digger.

These machines may not be in every way adapted to the wants and requirements of our system of farming, but it is supposed that they will be suggestive to our ingenious mechanics and that from them we shall get inventions that will prove highly valuable to the farming community.

The past season has been, in many respects, propitious, and the farming of the Commonwealth reasonably prosperous. The crops of hay and fruits have been better than usual. As I have already shown, in the earlier part of this Report, the returns of the United States census of 1870 are so defective that it is impossible to arrive at any near approximation to the comparative condition of our agriculture at the present time. The large number of farms entirely overlooked in gathering the statistics of the census, vitiated all the agricultural returns of every description. That such is the case appears from the fact that the total number of acres recognized in the census, including woodland and all improved and unimproved land of every kind, is but little more than half the actual acreage of the State. The area of this State, for instance, is about five millions of acres, or more accurately 4,992,000 acres, while the number of acres covered by or embraced in the census is only 2,730,283, a discrepancy of over two million two hundred and sixty thousand acres, altogether too large to be accounted for on any other supposition than a failure to find a large number of farms, a fact which appears also plainly enough on a comparison with the official returns of this Commonwealth. It is believed, however, that our agriculture, like all the other industrial interests of the State, has made a reasonable degree of progress, and that more trustworthy statistics will give sufficient ground for hopefulness and prosperity in the future.

CHARLES L. FLINT,

Secretary of the State Board of Agriculture.

BOSTON, January, 1873.

APPENDIX.

REPORTS OF DELEGATES

APPOINTED TO VISIT THE

AGRICULTURAL EXHIBITIONS.

BARNSTABLE.

As delegate from the State Board of Agriculture, I attended the twenty-ninth annual cattle-show and fair of the Barnstable Society, held at Barnstable on Tuesday and Wednesday, October 8th and 9th. I left my home at Nantucket on Monday, the 7th, with the intention of going to Barnstable that day; but found on my arrival at Wood's Hole, that I could not get there until late in the evening. I therefore decided, as the weather was stormy, to take the Tuesday morning train. On my arrival at the depot at Barnstable, in the midst of a severe rain, I found a carriage, provided by my friend, Major S. B. Phinney, in readiness to take me to his house, where I, together with my wife, was very kindly received by Mr. and Mrs. Phinney and family. The day was exceedingly unfavorable for the exhibition, as the rain literally poured down from the time of our arrival there until late in the evening, which prevented our going to the hall or ground. The following day was clear, with a strong west wind, and sharp, cold air. The exhibition of neat stock and horses was not very large, but of good quality. The display of poultry was very fine, among which I noticed some excellent geese, ducks, and other fowls from the Bacon farm. At the hall was a very large collection of manufactures, vegetables, fruits, flowers, fancy articles, bread and butter, all of which was tastefully arranged. I was surprised to see such large and beautiful specimens of vegetables and fruits. The eleven o'clock train brought His Excellency Gov. Washburn and Hon. Alfred Macy, of the executive council; also the Standish Guards and Independent Fire Company of Plymouth. The governor and council were met at the station by the officers of the society and escorted to the house of S. B. Phinney, Esq., chairman of the committee of arrangements. From there we passed to

the house of Francis Bacon, Esq., and after partaking of the hospitalities of Mr. and Mrs. Bacon, proceeded to the hall, where dinner was prepared for about three hundred and fifty persons. Hon. L. L. Goodspeed, president of the society, introduced to the company Gov. Washburn, who was heartily greeted, and who responded in very appropriate remarks. He spoke of Massachusetts being a manufacturing State, and that manufacturing could not be sustained without agriculture. Also told us that no class of persons were doing better at the present time than the agriculturists of the State, as they have a home market for all their crops. Hon. Alfred Macy followed, with his usual instructive and spicy remarks. Capt. Phinney, of the Guards, Freeman Martin of the fire company, Amos Otis and S. B. Phinney, Esq., briefly responded to complimentary sentiments. The ploughing-match took place at three o'clock, after which came off the exhibition of trotting-horses. There was some good trotting on the track by Dr. Chapman's horse "General," of Hyannis, Nathan Edson's horse "Josh Billings," and Nathaniel Swift's "Pompey." The exhibition closed in the evening with a grand ball, which was largely attended. I can but remember with gratitude the kindness of Hon. L. L. Goodspeed, president, and Charles F. Swift, Esq., secretary, for their attention, and S. B. Phinney, Esq., and his estimable wife and family, for their kind hospitality and untiring efforts to make our visit a pleasant one during our stay there.

A. M. Myrick.

BERKSHIRE.

The sixty-third annual exhibition of the Berkshire Agricultural Society occurred on the first, second and third days of October, 1872.

The weather was variable, the sun and clouds vying with each other in efforts to hold possession of the grounds. But notwithstanding this discouraging state of the weather, it was not enough to dampen the ardor of the Berkshire farmers, and their wives and children in celebrating this annual festival.

The ample and beautifully located grounds were filled with a large and happy concourse of people. One glance was sufficient to convince your delegate that the vast machinery of this society was in good working order, and under the guidance of skilful managers.

The pens and sheds were filled to repletion, and every available place on the grounds occupied with various kinds of farm-stock. The bovine race was represented by noble specimens of nearly every variety of thoroughbreds, and a large show of grade-stock.

There were more than one hundred entries in the horse department, which experts pronounced to be excellent.

The show of swine was not large, but of good quality. Poultry was in abundance, but did not claim my particular attention. The show of sheep was worthy of especial notice. The flocks of beautiful Merinos, Cotswolds and Southdowns brought vividly to my mind the scene, so often alluded to, of Elkanah Watson, exhibiting his imported Merinos under the shade of Pittsfield's celebrated elm, more than sixty years ago. The old man, the tree, and the sheep, long since passed away; but the spirit of this good man still lives, and the story of this first exhibition will be told to generations yet unborn. It is well it should be so. We need all the inspiration that comes from the good deeds of our ancestors. It is a happy thought that *good* is immortal; that a great thought or good deed never dies, but lingers around the scene that gave it birth, to strengthen all that comes within its influence. And if the spirit of this good man could but look down and see the great good that has flowed from his early endeavor, his highest ideal would be more than realized.

Watson's unpretending show was made in October, 1810, and though it excited the ridicule of the good people of that day and generation, who looked upon such a thing with a feeling bordering almost upon contempt, yet it was in reality the germ of the Berkshire Society, whose exhibitions began the following year, and are believed to have been the first county agricultural exhibitions held in this country. From that small beginning, seen through the eyes of prejudice, chiefly perhaps because it was new, the whole system of developing the material resources of the country by exhibitions has grown up, and no one at this day can doubt that it has been productive of vast good to the community.

But to return to the more legitimate objects of this report, I will say that every department of this exhibition was creditably represented and worthy the industry and enterprise of the farmers of Berkshire. To give you a detailed report would be impossible, but to give you some idea of its magnitude, I have only to enumerate some of the entries made. In all there were between seventeen and eighteen hundred, among which were the following: Field-crops, 350; farms, 26; orchards, 25; reclaimed meadows, 5; and compost-heaps, 11. I was glad to to see the good example set by offering premiums for the latter; for with proper attention to the preparation of manures, farming can be made profitable, while without it our sons are compelled to seek other employments for a livelihood. I trust every society in the State will follow this example, and acknowledge its importance by offering premiums to its members to utilize all the vegetable and other convertible waste matters of the farm. About one thousand premiums were paid, amounting in all to the sum of $2,974.

Nearly one thousand entries were made of articles within the exhibition hall, embracing butter, cheese, bread, vegetables, seeds, grain, fruits, flowers, articles of domestic manufacture in great profusion, paintings and other productions of the fine arts, mechanical productions of various kinds, &c., &c.

The exhibition reflects great credit on the society, and great honor on the State whose generous bounty is thus well rewardep, and returns with tenfold blessings to the whole people.

Words are inadequate to express my obligations to the officers and members for their kind consideration and their sympathy in my unfortunate indisposition.

> "He that hath nature in him must be grateful;
> 'Tis the Creator's primary great law
> That links the chain of beings to each other."

ELIPHALET STONE.

DEERFIELD VALLEY.

It is with pleasure that I am permitted to respond to the earnest solicitation of the honorable member from Athol, who was unable to be present at the Deerfield Valley fair, by reporting to this Board, that the second cattle-show and fair of the Deerfield Valley Agricultural Society opened in Charlemont, on Tuesday, September 24th. The fog and mist of the morning were early dispelled by the rays of the sun. Arriving in the village about nine o'clock, A. M., I immediately repaired to the elevated plateau, which claims (and I think justly) to be as good a location for an agricultural fair as can be found in the State; surrounded by hills and high-soaring peaks, with the narrow valley upon the south, through which the waters of the Deerfield River quietly flow.

The society's track, which is almost level; the hall, sixty by forty-five feet, two stories high; the barn, with a sufficient capacity to accommodate fifty horses; water in the barn and on the grounds; Fairbanks' scales, in the right place, indicate an interest and stamina among the members of the society seldom surpassed.

It was apparent at an early hour that the second show of this society was to be a grand success, there appearing some of the finest blooded stock in New England.

When such stock-breeders as Fogg, of Deerfield, Anderson, of Shelburne, Hayward, of Plainfield, and others confirm their confidence in this new society by the presence of their famous herds, it should silence all question of doubt in the wisdom of the State's bestowing its bounty upon this enterprising institution. The larg-

est herd exhibited was Mr. Anderson's selection of twenty-four head, among which were five yearling heifers, averaging one thousand two hundred and sixty pounds each, three ten months old heifer calves, seven hundred pounds each.

There were several other fine herds from Charlemont and the adjoining towns. There were about twenty bulls, eleven thoroughbreds, of five different breeds, about fifty pairs of oxen and steers, a goodly number of thoroughbred cows and heifers, making the number of neat stock on exhibition over two hundred, a creditable display of quality as well as numbers for any community.

The show of swine was meagre, and the poultry fever did not seem very contagious. There were several flocks of sheep, which were a credit to their owners; some fine specimens of trout, from the hatching-ponds of Booth and Thayer, who are said to have sold three hundred dollars' worth of these fish the past season, and are anticipating a lucrative business in the future.

The hall department of the fair was very creditable. There were three hundred and forty entries in this department, including grains, vegetables, fruits, dairy products, bread, honey and sirups, mechanic arts, domestic manufactures, fancy articles, flowers, knitting, with many fine specimens in each of the various collections.

The society's dinner being served up in pure agricultural style, where they have something to eat, was discussed with that ability and decorum of which practical agriculturists are possessed. Our physical wants being fully supplied, the band led the crowd to the speaker's stand, where, it had been announced, they would be addressed by ex-Governor Claflin.

President Leavitt, having informed the audience that by reason of a railroad mistake the ex-Governor was not present, reported somewhat the condition of the society; then adopted a code of entertainment, which in musical circles would be termed a swell, by opening with the feeble efforts of your humble reporter, expanding into a Doctor's Oratory, arriving at the full fortissimo of the Hon. Joseph White, of educational fame, thence receding in about the same ratio with the lawyer's effort, culminating in a pianissimo, which occupied an hour's time of an attentive audience. The remaining noticeable feature of the first day was a half mile foot-race, with premiums, three, two and one dollars.

On the second day the attendance was larger than on the preceding day, showing that "the horse will draw the crowd." Equally ambitious seemed the horse, to demonstrate that there is not a nobler animal for man's assistance than he, by calling into line one hundred and twenty-two entries of his kind, and there was scarcely a poor animal among them. The forenoon was spent in the exam-

ination of the different classes of horses and colts. After dinner it was announced that ex-Governor Claflin had arrived, and would atone for the previous day's disappointment. He spoke a half hour upon the advantages our farmer boys would enjoy by remaining at home; he said our Yankee boys were giving their inheritance to the foreigners generally. The next attraction was a trial of speed of horses, followed by a sack-race; and a ball in the evening in Agricultural Hall closed the festivities.

Your reporter would acknowledge the bountiful hospitality and courtesy received on this occasion.

T. L. Allis.

ESSEX.

The Essex Agricultural Society held its fifty-second annual exhibition at Gloucester, September 24th and 25th, 1872. The delegate selected by the Board of Agriculture to attend and report upon the proceedings of this society was S. B. Phinney, Esq., of Barnstable; but he having been unavoidably detained from being present, the undersigned has been requested to make this report for him.

The exhibition, which was held for the first time in the history of the society at Gloucester, was in all respects successful. The interest manifested by the members was unabated—indicating the good effects of that change of location which has been adopted by this society from its foundation. The committees were promptly filled: the trustees were chosen in a harmonious spirit, and the venerable president discharged his duties with his usual promptness and liberality, and entered upon another year of service with new zeal and devotion to the interests of the association.

The people of the town took a great interest in the fair, and added eighty-five names to the list of members from Gloucester.

The grounds on which the cattle-pens and the tent for implements of husbandry were located were very beautiful and attractive, commanding a delightful view of the harbor of Gloucester, and possessing a deep historic interest from the fact that it was the spot on which the earliest pilgrims to Essex County pitched their tents, and responded across Massachusetts Bay to the bold and true-hearted who were struggling through the painful trials of the first years at Plymouth. On these grounds were collected many praiseworthy specimens of the domestic animals of Essex County, and a fine collection of the results of mechanical ingenuity and skill applied to the improvement of the implements of agriculture. The working

oxen were quite remarkable, and a town team of thirty-two yokes, made up from the quarries of Gloucester and Rockport, contained more first-class, well-made, heavy and thrifty cattle than we have ever seen together before, and fewer poor ones. Among the bulls, cows and horses were many meritorious animals—varying materially in size, shape and condition. The collection of poultry was large and fine. Upon all these classes the committees have made elaborate and excellent reports, manifestly endeavoring to perform their duty well, and making some valuable suggestions to the owners of the animals and to the society which offers them its encouragement.

Passing from the grounds, where, by the way, we witnessed one of the best contested ploughing-matches, we entered the spacious hall, provided by the town of Gloucester, for the exhibition of fruit, crops, flowers and various articles of domestic manufacture. Here the usual skill of the cultivators and manufacturers of Essex County was manifest. And the display of fruit was largely enhanced in attractiveness by being arranged in the comely and well-fashioned dishes with which the society has recently provided itself.

It is sometimes asked, How is it that the Essex Agricultural Society, after so many years of existence, in a county where manufacturers are gradually absorbing the active forces of society, and with the liberal system which necessarily attends its migratory habits, should maintain such even and continued prosperity? That it owes much to the economy, efficiency and good judgment of its officers there can be no doubt. But it also owes much to the universal interest felt in its welfare throughout the county—an interest which is largely encouraged by the fact that every section of the county is visited by the society with its exhibitions. But turn to the annual report of the society, and the secret of its success is at once made manifest. The marks of labor and diligent thought are there everywhere apparent. The committees devote themselves to their reports; the competitors are careful in making up their statements; for fifty years the residents of the county have held themselves in readiness to be called upon for the annual address; and the work of setting forth the views and practices of those interested in agriculture has been diligently continued. Timothy Pickering and his illustrious cotemporaries set a good example when they founded the society; we are happy to say that their example is not yet forgotten.

Geo. B. Loring.

FRANKLIN.

The twenty-third annual cattle-show and fair of the Franklin County Agricultural Society, was held at Greenfield, September 26th and 27th.

Events beyond my control prevented my reaching there by the early train the first day, as I expected to have done, which was a great disappointment. On my arrival in the afternoon, I found the streets flooded with water, and the rain pouring in torrents, and that a large portion of the stock had already left the grounds. I had anticipated much pleasure and profit from my visit as delegate to this society; having had some general acquaintance with the stock and style of farming in this county, I wished to become more thoroughly acquainted with the details.

I consider it the duty of a delegate to be at his post from the commencement until the close, and if in his opinion there is anything new or of practical importance, to be able from personal observation to report it.

There was rain, mud, disappointment, sour faces and discouragement upon the grounds; but when your delegate entered Washington Hall, he at once met a different aspect. Here was beauty upon every hand, and successful smiles made radiant every face. Yes, here was success that the rain could not mar, triumph that paid for much discomfort to witness; here, in the face of discouragement, and in spite of the elements, was one of the best exhibitions the society has ever made,—a very Eden of loveliness.

W. L. Warner, Esq., superintendent of the hall, evidently understands his business; has an eye for the blending of colors and the artistic arrangement of articles so as to display them to the best advantage.

The show of vegetables was fair, though reported not as good as on some former years. J. F. Coburn exhibited one hundred varieties of beans, one of which in size was infinitesimal.

Of fruit there was a great abundance. J. M. Smith, of Sunderland, had 135 plates of miscellaneous fruit, and W. L. Warner had 125. Several other gentlemen had large and well-selected assortments; three of them, fifty or more varieties of apples each.

A very large number of peaches was exhibited, and they were said by some to be "the best thing of the whole show."

Pears and grapes were each abundant, some entries having more than twenty varieties.

There were several attractive baskets of mixed fruit, and the nicest taste displayed in their arrangement. These were furnished

by Mrs. Julia D. Peck, Mrs. Henry Wells, Miss Sarah Anderson, of Shelburne, and H. D. Graves, of Sunderland.

The highest state of cultivation is necessary to produce the perfection in the fruit that was on exhibition; and the farmers in this section without doubt can furnish some important information relative to the soil best adapted to this branch of husbandry, and the comparative profits of fruit-growing.

Of the floral department the society could well feel proud, as the flowers were very choice and the floral designs exquisitely beautiful. One could but wonder and admire.

Here also was attested the skill of the artist in the neat, elaborate and tasteful designs for embroidery, wax-work, &c.; in fine, everything bore the impress of perfection.

I was informed by members of the committee that some of the finest animals in the county were on exhibition; and I know that among the Franklin farmers is found much of the very best stock, and many successful stock-raisers.

I found on the grounds (for exhibition only) the Shorthorn herd of Mr. Whitman, of Fitchburg, and the Devon herd of Mr. Mattoon, of Springfield, both of which were made up of very superior animals.

We noticed among the entries the weight of several of the animals as follows:—One pair of four-year olds, 5,008 pounds; one pair of three-year olds, 3,890; four pairs of two-year olds, 3,040, 2,936, 2,900, and 2,414; twelve pairs of oxen from Deerfield average weight 4,102 pounds; four cows, 1,700 pounds each.

There was a fair show of good horses, which no doubt would have been much greater but for the rain; and while I admired the pluck of those who appeared and drove around the muddy track, I could but honor the judgment of those who were so considerate for the welfare of their animals as to leave them at home.

That the Franklin Society has active workers is evident, not only by the amount contributed, but in the zeal with which the officers labored in the face of difficulties to make the best of everything. A society which can carry out a programme in such a drenching rain is a healthy organization, and will succeed.

J. McElwain.

HAMPDEN.

The Hampden Agricultural Society, originally organized by and located in the midst of an active and prosperous agricultural community, has, by increase of population, by the modern changes in business interests and channels of trade, found its headquarters and centre of activity surrounded by the rapidly increasing com-

mercial and manufacturing city of Springfield. Other interests in that locality have got possession of the farms of its original members, which are worth now by the foot more than they then were by the acre, and agricultural interests and labor has been obliged to seek other fields for their development. Its valuable property in grounds and buildings has really become the pleasure and public driving park of the citizens, a place for promenading, for city shows and exhibitions. For several years a sharp but smothered contest has been going on between these city interests and influences and the society respecting the control, management and use of the grounds. A more than usually exciting contest, during the last winter and spring, resulted in victory to city interests, and a liberal offer being made as an inducement, the society, this year, held its exhibition on the public common of the old town of Westfield. This exhibition was eminently an old-fashioned cattle-show with all its features of interested but genuine agriculturists-stock and farm products on the first day, and breeding horses and colts, agricultural address and public farmers' dinner with common-sense speeches the second day. The only thing needed to make the spectator think he was living the good old times over again, was the ploughing-match, and the only improvement of modern times that was missed was the fickle, excitable crowd who see nothing and care for nothing but "horse," the lank, lean, scrawny equines imported from distant race-courses, and the peculiar and not very elevating slang of the turf in conversational circles. The stock exhibition was good and eminently modern, with specimens and herds of the improved breeds reared by their exhibitors, and giving indications of nice discrimination and skill on the part of their owners. Formerly the town of Westfield was really famous for its fat cattle, and its farmers yet boast of their laurels, but though all other kinds of stock were abundant in the exhibition, fat cattle were entirely wanting, indicating a great change in the leading pursuit of Hampden farmers or a backwardness in putting them on exhibition. In the departments of growing horses, milking stock, grains, roots, vegetables, fruit, domestic manufactures and agricultural implements and machines, the exhibition was praiseworthy. Great interest seemed to be taken by spectators in every part of the show, which could not fail to exert a salutary influence through an extensive farming community. The membership of the society has been largely increased during the past year, its funds have been augmented, and its ability and opportunity for carrying forward the work of its organization has been materially advanced.

LEVI STOCKBRIDGE.

HAMPDEN EAST.

The annual exhibition of the Hampden East Society, was held on its grounds in Palmer, on the 8th and 9th of October.

The morning of the first day was one of the most unpropitious of the season, a heavy rain falling all the early part of the forenoon, and we feared a failure of the exhibition; but when we arrived on the ground, between nine and ten o'clock, we found the farmers had pushed out and were determined to have a show. The ladies had also braved rain and mud, and were filling the hall with plants and bouquets, and adorning it with articles of utility and beauty.

This society has recently sold the grounds they formerly occupied, and purchased new ones which are well located and finely adapted to meet their wants. A new hall has been erected for the use of the society; the lower story for the display of the various industries, and the upper, we presume, as a place to satisfy the "inner man," and where the "flow of soul" would stimulate to new activities. We understand that the unfinished condition of the upper room prevented it from being occupied for either of the above mentioned purposes on the present occasion, and necessitated the use of a hotel in its stead.

Your delegate was received by the officers of this society with every mark of attention and courtesy, and every means in their power was afforded him to make a fair estimate of all the elements represented,—the general prosperity of the society, and its reflex influence upon the agricultural community in this part of the State. The cattle-pens were well filled with the various breeds of cattle; mostly being grade Durhams and Ayrshires, with an occasional Devon and Jersey.

A valuable contribution to this department was made by Dr. Wakefield, of the state primary school, Monson, of a herd of twenty cows,—mostly grade Durhams and Ayrshires. This herd was one of the best, considering its size, that is often seen, and reflects much credit on the superintendent for his good judgment in the selection of stock. Its exhibition at the fair gave the farmers an opportunity to judge correctly the appearance of good milkers; each cow's milk is always weighed night and morning, and a record made; the poor ones are disposed of and only the best kept. We might mention the merits of the herd of Mr. Graves and others, but it must suffice for us to say that we believe there was a fair representation of all the various kinds of stock kept in this vicinity, which, however, does not appear to be so large in numbers, or so high a quality, as a whole, as in some other parts of the State. The ploughing and

exhibition of working oxen were worthy of much credit. The men who exhibited in this department, with their well-trained cattle, understood their business, and imparted a useful lesson; most of them have given similar instructions at nearly all the fairs in Worcester County.

The display in the hall was good,—a large variety of vegetables from the field and garden, good specimens of the different kinds of grains,—and the whole room tastefully adorned with the handiwork of the ladies, and plants and flowers. The exhibition for the second day was confined to horses, in all their different classes, and the reading of the reports of committees. It is claimed by some that this society is taking higher moral ground on the subject of horse-racing than many of our societies. No premium is offered where simply speed governs the award. We regretted not being able to be present the second day, which, with fair weather and a larger attendance, is said to have met with a reasonable degree of success.

The present officers of this society would seem to be doing what they can to bring it up to a respectable rank with the other societies of the State, for which they are to be commended. But we must not close without giving it as our opinion that it is not time for them yet "to rest on their laurels."

THOMAS P. ROOT.

HAMPSHIRE.

The Hampshire Agricultural Society, to which I had the honor of being accredited by the Board, belongs to the smaller class of societies. Of the thirty-one incorporated agricultural societies in the State twenty-seven in 1871 had larger receipts of money and twenty paid out more in premiums and gratuities. It has the good fortune, however, to be less weighted with debt than some, and we ought to acknowledge that the measure of success of an agricultural society cannot be seen in its financial exhibit. Indeed, I think it would not be surprising, should a careful survey of the work of all our societies be had, were it found that some of the smaller, rather than the larger and perhaps more pretentious societies, most merited our support.

Having its seat in the heart of a beautiful valley, the most fertile in New England, yet with border-lands that through past neglect now demand the most searching thought to devise profitable methods of improvement, the Hampshire Society ought to unite in its behalf the hearty support of the neighboring population. I have yet to learn of the society which does this, and I believe it is due in

great measure to insufficient views as to the good service which an agricultural society may be made to render the farming community; and from a well-founded conviction, that as at present conducted they do not render to agriculture sufficient direct and substantial service, freed from all objectionable influences, it affords me much pleasure to say, and it will gratify the Board to learn, that an innovation in the custom of the society which required all persons entering the inclosed grounds to pay a fee—an innovation which had been much and apprehensively discussed—did not, so far as I could learn, materially reduce the ordinary attendance.

There was gathered on September 24th and 25th a goodly display of the products of the farm, a virtuous population, live stock, fruits, vegetables and miscellanies. The live-stock mostly left the grounds the first day. The animals belonging to the State College were enough in number and of sufficient quality to make an interesting and instructive collection. It was instructive, insomuch as it offered for our examination specimens of various breeds from which we may be better informed ourselves of their several excellences. Devon, Shorthorn, Ayrshire, Swiss, Brittany and Dutch of the Chenery importation claimed our attention. The college showed also varieties of pigeons, always beautiful, and illustrating most convincingly the plasticity of species. Such exhibitions renew the courage of breeders in attempts to fasten upon flesh such distinctions as make animals more serviceable to man and as may be established in the blood.

Upon my arrival upon the grounds, early in the afternoon of the first day, most of the live-stock other than what was contributed by the college, was removed, and I saw only the town teams as they were passing out the gate. A few hours' showing serve to win the honors, and the literal cattle-show is a thing of the past. It occurred to me that as the attendance the first day is less than on the second, which usually combines more features of interest, that not so many persons have opportunity to derive advantage from the showing of cattle as the expenditure of the society for this interest should purchase.

The award of premiums, I suppose, is rather designed to instruct the public as to what constitutes a good animal, than to either entice cattle upon the grounds or to gratify with a gift particular individuals. Though the cattle were early gone, and the horse had no place in the programme of the first day, there was introduced a novelty which was so entertaining as to retain the crowd, which was composed largely of the younger population, to a late hour, and which was so innocent as not to be open to objection, and I think merits our commendation. I refer to the Scottish athletic games.

The programme named them as follows, with the premium,—the first of $5; the second of $3; the third of $1, making an outlay by the society, when competed for, of $108:—Putting heavy stone; running long jump; throwing heavy hammer; half-mile race; tossing caber; hurdle-race; throwing light hammer; standing high leap; hop-step and jump; three-legged race; vaulting with pole; sack race.

There was introduced also the Scottish broad-sword dance, showing marvellous grace and lightness of movement, while the ear was engaged with tones of the ancient bagpipe, and the eye when taken from the dance rested upon the Highland musician in full national costume.

There was but little in all this to remind of the circus, and there were displayed accomplishments of muscle, of endurance, of movement, such as find place in a farmer's exercises, and adorn and ennoble the human being. If some may not go to this length of expression, and deem it extravagant, all will agree that to be able to throw a twenty-two pound weight sixty-seven and one-half feet, vaulting with a pole seven feet eight inches, and that repeatedly, with other exercises such as only great muscle and heroic spirit permit, show useful powers. Let the most of us attempt these performances and we blush for the little we can do.

The exhibition in the hall told of the varied fruits, which our soil, when rightly treated, is capable of producing. The Agricultural College furnished the largest contribution. It displayed noticeably a half dozen varieties of beets which have been analyzed at the college for the sugar which they severally contain, some fruit, and most magnificent plants. But there was nothing in this corporate contribution to abash the lone cultivator, who displayed in many instances articles quite the equal of the college, with its store of learned minds. I cannot name them all, but such was T. G. Huntington, of Hadley, who entered a collection of vegetables—specimens not over-large but sound, fair, and of even quality, and of grapes six plates. Mrs. Graves, of Sunderland, showed a basket of various kinds of fruit, each specimen of which was free from blemish, and noticeably were five plates of peaches raised by T. B. Page, of Amherst. Horticulture has much to teach, and among its lessons none is more important than this,—that the perfection of vegetables and fruits is rather to be found in excellence of flavor, soundness, freedom from blemish and uniformity than in great size or oddity of form. There was no "Club of Hercules" at this fair, and I hope none to award premium to monstrosities. If the fruit was not of the highest quality, and does not equal the collections sometimes shown at the exhibitions of the Middlesex Society and some other

fairs in the State, it should be remembered that Hampshire has not a Wilder close at hand,

> "To unlock the soil for fruit to grow
> And inspire in many their taste to know;"

nor perhaps a Moore, whose energies cheapen transportation, and make cities feed from our own gardens.

Dinner wss furnished in the upper hall of the society, but not at its expense, nor in formal style. After the dining-hour the people collected to hear an address from Prof. Stockbridge upon the subject, "Does Farming Pay?" It was listened to with courteous attention, and whoever looked over the audience and reflected upon the exposition of agriculture below, and thought of the homesteads of those present, comfortable always, and often luxurious, would not reject the affirmative answer of the speaker. Agriculture is specially profitable among some of the people, insomuch that they devote their attention largely to the cultivation of a plant which the soil invites, and though objected to by some, fills the whole valley with good cheer, that comes of enormous dividends upon investment. The average growing of this plant, within ten towns, has increased from sixty-eight acres in 1855 to near one thousand at present; from the centre of the society's grounds, buildings, designed for its use, may be seen on every side—the earth under our feet is suited to grow it, and taking the average of the State in 1870, the area occupied with the plant produced a gross return above ten times the gross value of eight chief crops, at a moment when we are informed officially by the Chief of the Bureau of the Statistics of Labor, that "since 1850 there has been no remarkable increase in the quantity of agricultural produce, except in the tobacco, orchard and market garden crops." Tobacco growing receives no recognition from this or any other agricultural society. I feel little disposition to drag an outlaw into the presence of the Board, but since tobacco must be regarded as one of a very few crops which uphold the agriculture of the State, save our farms from neglect and the rural population from migration; since also the presence of the weed is always perceptible with us, and the growing of the weed is further removed from any question of morals than the use of it, I deem the subject not beneath, but as deserving our thought.

"The agricultural horse trot" has attractions at Amherst, as elsewhere. I was pleased, however, to observe that the showing of the carriage-horses and roadsters enlisted from those present nearly as much interest as the professional trotters. The horse does not appear to have so great or baneful an influence on character here as in some other sections, nor did I observe, either on the part of

drivers, or in the make-up of the crowd, anything to suggest a censuring remark. Rather would I speak praise and dwell upon the high-toned character of the management, and the educated, well-behaving aspect of the people, carrying in their countenances little of the foreign look so common in the eastern part of the State, and regarding the occasion as a farmer's festival to be improved, rather than idly loafed away. I may remark, in conclusion, that liquor, as should be presumed, was not tasted in shy hospitality, nor was there to be found, so far as my observation or judgment informs me, any but a wholesome influence pervading and animating the occasion. Respectfully submitted,

JOSEPH N. STURTEVANT.

HAMPSHIRE, FRANKLIN AND HAMPDEN.

The fifty-fifth exhibition of the Hampshire, Franklin and Hampden Agricultural Society was held at Northampton, on the third and fourth of October last.

The delegate assigned not being able to be present, the president of the association and member of our Board invited me to be present and report.

It was an auspicious autumn morning on which the exhibition of this venerable society of the valley opened,—the parent from which the sturdy sons of Franklin, Hampden and Hampshire East have emanated, and who delight to honor their sire by contributing largely to sustain his renowned reputation.

On entering the fair-grounds, I could but congratulate them on the admirable improvement in remodelling, by adding two acres on the north side of the enclosure, the moving of the hall, the arrangement of the cattle-sheds, making ample accommodations for eighty head, or more, of cattle under cover, pens and hitching-posts, with a fine track, superbly graded, with an abundance of aqueduct water to quench the thirst of man and beast.

The Franklin department was on the ground the previous evening,—140 head, thirteen carloads of some of her best selections, among which was the herd of the Carpenter Brothers, of Shelburne, 41 head, the largest herd on exhibition; quite a proportion of thoroughbred Durhams; also 24 head by I. S. Anderson, of the same place, selected from his stock of 40, embracing one pair of four-year old steers weighing 5,008 pounds; two pairs of two-year old, weighing 3,000 pounds per pair; one three-year old heifer, weighing 1,700 pounds; a fine herd of M. I. Smith & Son, of Smith's Ferry, of 20 thoroughbred Durhams, and several smaller breeds equally good in

quality. The Jersey and Ayrshire breeds, from Chicopee and Gill, made an admirable exhibit of their kind. D. O. Fisk, of Shelburne, received the first premium on single cows. The superintendent of the state agricultural farm exhibited seven distinct breeds, among which were some very fine animals. Deerfield appeared with her banner string of oxen, 17 pairs, averaging 4,150 pounds per pair; the heaviest pair belonging to I. H. Stebbins, weight 5,960. There were a goodly number of oxen from Northampton and Hadley that would compare well with their aforesaid neighbors. There was a large and fine exhibition of bulls, among which were the Hatfield Roan Duke and Deerfield Buttercup. There were several entries of swine, and but three flocks of sheep; the Southdowns largely preponderating. Nothing of special value in the poultry department was noticed.

Agricultural implements and mechanic arts were present in full force; mowing-machines predominating in the field, and sewing-machines in the hall.

The show in the hall was much better arranged for the exhibition of the various articles, although inferior in many respects to the exhibit of former years. The display of fruit was less in quantity than in some previous years, notwithstanding the abundance, especially of apples, up and down the valley; everybody thought that "everybody else would bring an abundance, therefore no need of mine"; hence the deficit; which should admonish every member of his own present responsibility in this as well as in other departments. Pears, peaches, grapes and quinces appeared in limited quantities, but superb in quality. The display of greenhouse plants was exquisitely fine. Flowers but few, and beautiful. The show of vegetables meagre. Bread, four entries; butter, four. A creditable exhibit of canned fruits. A collection of 250 varieties of potatoes; 20 of corn; several of apples and of onions. A large variety of grains; prairie-grasses six feet high. Corn, grown on twenty-foot stalks, from Iowa and Nebraska, formed an interesting feature of the exhibition. The department of domestic manufactures was fully sustained, while the fancy-work received a large share of praise.

The gathering in the upper hall, at one o'clock, was to listen to the address of Rev. Dr. Seelye, of Easthampton, who spoke about thirty minutes, with his usual eloquence, demonstrating that the occupation of the farmer was fitted to develop the ideal of manhood; that physical strength was the first requisite; that employment in agriculture tended to expand the intellect, and to give man broad views of nature and of life.

Some spirited horse-trotting closed the first day's display. The second, or horse day of the fair, was a grand success; the weather was

delightful. The crowd of vehicles was very great, and the number of people, estimated at ten thousand, confirms the declaration that old America, as well as young, are eager to witness a good horse-trot. There were 130 entries of horses. The grand cavalcade around the track at ten o'clock was headed by the Haydenville Band, of musical fame. The show of horses in its various departments was highly creditable. At one o'clock about three hundred sat down to an excellent dinner, after which the horse display ended the programme, to the tune of five hundred dollars more receipts than in any previous year since the society's organization. Good order prevailed, and the society and its officers were congratulated on their success.

Your reporter will close by acknowledging to the officers his appreciation of the kind hospitality and marked courtesy received at their hands.

THOS. L. ALLIS.

HIGHLAND.

The morning of September 12th found me on my way to attend the seventeenth annual exhibition of the Highland Agricultural Society, at Middlefield; "a city set on a hill, and one of the pleasantest and most healthy places I ever was in," said a railroad official to me, and after riding several miles in a well-packed omnibus, I beheld and confirmed his declaration.

The true spirit of an enthusiastic agricultural community seemed to be present in all the departments attendant on this occasion. The day was fine, and so was the stock. The Devons, Jerseys and Ayrshires came into line with the Durhams for their full share of the honors. The thoroughbred Shorthorn, Duke of Clarence, four years' old, weight 2,600 pounds (exhibited by C. B. Wright, of Middlefield, who received fourteen premiums on the various classes of his herd), would be hard to beat. So think the famous stock-raisers, Andersons, of Shelburne, as they have since purchased him, and declare him to be equal if not superior to any stock they have ever owned.

Middlefield and vicinity's reputation for good stock was fully sustained at this show; several yearlings, progeny of the Duke, were fine animals. A creditable show of oxen, several yokes of three-year old steers, would rank with the best of New England; some fine cows and heifers, the whole numbering one hundred and fifty head of neat stock. The exhibition of sheep was in fair proportion, that of swine and poultry rather diminutive; and there were but few agricultural implements.

The exhibition in the hall was almost destitute of merchants' advertising products, making it strictly an agricultural and domestic display. Samples of grain, sixty-two entries; fruits and vegetables, forty entries, with the dairy exhibit, were highly creditable.

The good taste and skill of the ladies were noticeable in the various manufactured articles there exhibited. The assemblage in the hall, in the evening, to listen to brief addresses and music, was large and orderly, making it one of the most pleasant features of the fair. The second day opened with a dense fog, which soon set in for a powerful rain, which interfered greatly with the show's success.

After dinner, the address of the Hon. S. B. Quigley, of Southampton, was listened to with marked attention, as he in the main discoursed upon the topic of agriculture; and music from the band winding up the entertainment, the awards of premiums were announced.

With an acknowledgment of the bountiful hospitality received at the hands of the secretary and his hostess, and the agreeable courtesy and attention of the officers and members in general, I subscribe myself,

Thos. L. Allis.

HINGHAM.

The annual exhibition of the Hingham Agricultural and Horticultural Society was held on the society's grounds at Hingham on Tuesday and Wednesday, September 24th and 25th. This society has been attended with great prosperity from its foundation, and it continues to manage its affairs with vigor, good judgment, and success. That it has stimulated the agriculture of the section which it covers, cannot be doubted. Its members excel in many branches of farming to which they have devoted themselves, and in which they have been encouraged by their associates and by the liberal bounty of the society. The monthly meetings, which last year were fully attended, have done much to rouse a spirit of investigation, and the papers which have been prepared for these occasions upon the "Construction of Highways," "The Manner of Managing Grass-lands," "The Orchard," "Agricultural Education," and "Market Gardening," form a valuable addition to the agricultural writing of our State.

The exhibition was very successful. The arrangement of the grounds was admirable, and the hall, one of the best and most thoroughly equipped and furnished in the Commonwealth, was well filled with most attractive specimens of agricultural products and

handiwork. The entries, both on the grounds and in the hall, were numerous and of good quality. From the report of the society I learn that, among the noticeable features of the show, "were one hundred and two varieties of apples, and three hundred and two dishes; three hundred and fifty-eight dishes of pears, embracing ninety varieties; one hundred and four dishes of grapes, and forty-five varieties; upwards of two hundred pot-plants, floral designs and bouquets; one hundred and twenty-eight sheep; one hundred and thirty-nine swine, and one hundred and eighty-nine poultry; while the beef-cattle, cows, heifers and horses have never been surpassed at any previous exhibition of the society. There was a ploughing-match, exhibition of horses, trial of draught-horses, and of working oxen; rural sports, and a dinner in the hall of the society."

The committees of this society set a good example in the preparation of their reports. The statements of the competitors are carefully examined by them, and the deductions to be made are carefully drawn. By them we learn, in the matter of crops, that in corn crops entered by Hon. Albert Fearing:—"Where, last year, there were one hundred and twelve bushels of yellow corn, costing sixty-nine cents per bushels, this year's yield weighs but eighty-one bushels, costing ninety-four cents per bushel. The yield of Whitman corn, this year, is at the rate of eighty-seven bushels to the acre, costing but eighty-four cents per bushel, while that of last year was one hundred and five bushels to the acre, costing seventy-four cents per bushel:"—the difference being attributable mainly to the inauspicious weather during the entire corn season. The statement with regard to root-crops is interesting. Two-thirds of an acre of mangel-wurzel cost $129.25; two-thirds of an acre of ruta-bagas cost $94.25. The yield of the former was 2,088 bushels to the acre; the yield of the latter was 912 bushels to the acre. In the report upon sheep it appears that thirty-nine old sheep, ten yearlings and three bucks, yielded in wool and lambs, in the year 1872, $541.08; three sheep, belonging to Messrs. Jones, yielded, in 1870, $39.20; in 1871, $74.20; and in 1872, $54.27. In the report upon ploughing, the committee wisely remark:—"We think a plough should be so constructed as to run a good furrow alone; that is, it should be so balanced as to move steadily and be under the perfect control of the ploughman without great labor, and a saving would then be made by his being his own driver."

The exhibition of horses was good; that of poultry excellent; and that of swine up to the standard long ago established by this society.

In every respect the Hingham Society reflects credit upon those

who have it in charge. Its efforts are confined to no single sphere; but while it is entirely engaged in encouraging the practical work of the farm and garden, it appeals also to the mental energy of its members. And we commend the closing sentences of an essay written by one of its members, Hosea G. Goodrich, Esq., in which he says:—"Where knowledge is largely diffused, power and wealth accumulate, and where they are, the soil will be cultivated for pleasure or profit. The more extended our general education, supplemented by a special one, the better shall we be able to meet the difficulties in the way of our agricultural interests."

GEO. B. LORING.

HOOSAC VALLEY.

The thirteenth annual fair of the Hoosac Valley Agricultural Society was held at North Adams on Tuesday, Wednesday and Thursday, September 17th, 18th and 19th. Owing to the powerful rain of the night previous, and which did not abate till the morning of the first day, and also a delay at Pittsfield in the connection of trains, I was not on the grounds of the society until late in the day; consequently did not see as much of the stock as I should have been glad to have seen. What I did see were good specimens of the various breeds of Durhams, Devons, Ayrshires, and the native stock. Some of the stock, I was told, was not on exhibition more than two or three hours, although the fair was continued three days.

With the conveniences of this and other societies, it seems to me the stock should be kept on exhibition the second day, especially if the show is held three days. Give all the various kinds of stock at least an equal chance with the horse, if they are not as symmetrical in form, or attractive in their movements.

The hall has been enlarged and is quite spacious, and was not particularly crowded, although in many departments the exhibition was very good. There were fifty-two specimens of bread, showing that the ladies are not wanting to do their share. I noticed several factory cheese, of large proportions and good quality; also dairy cheese, as well as fine specimens of butter. A large quantity of corn was exhibited, showing that Berkshire soil is well adapted to the growing of this crop. There is more interest in the department of field-crops in this county, than in any other section of the State. This society had 148 entries of summer and fall crops, and many of the samples were on exhibition. Would it not be well for other societies to imitate their example in this respect?

Specimens of goods were exhibited from the manufactories of North Adams; fancy articles were numerous; flowers and fruit were seen in one part of the hall, with carriages and stoves in the opposite. The display of fruit was not large.

The second day was devoted to horses. The morning was wet; and at the hour appointed there were but few in attendance. But before noon the park was alive with people and horses. Some fine work-horses were exhibited, as well as pairs, and single trotting-horses. The horse seemed to be the prominent feature of the show. I was told that the cattle-men had been urged to bring up their part of the show, but had failed to manifest an equal enthusiasm with those interested in the horse.

There is much enterprise in this society; and the past year has brought in seventy-five new members. They have a fine park of twenty acres, with a new barn for the accommodation of horses to be kept through the show. (Why not for cattle also?) The hall is a little peculiar, being in the form of a cross, 90 by 140 feet, with a speaker's stand in the centre. The third and last day a powerful rain set in about eight o'clock, and at ten your delegate left, feeling that nothing more could be done. But before noon it cleared away, and I was told that people assembled in large numbers; and that the trotting was very good.

Good order prevailed, and the enthusiasm of the officers and managers of this society showed that they expected nothing but complete successs.

N. S. Hubbard.

HOUSATONIC.

The annual exhibition of the Housatonic Agricultural Society was held at Great Barrington September 25, 26 and 27; and as is usual with this society every element that is necessary to make up a first-class cattle-show was there in abundance. The hall, grounds and other appointments will compare favorably with that of any society that I have visited.

The cattle were mostly grade Shorthorns, and some splendid cows of that class were on exhibition, and by their side were the thoroughbred bulls that begat them, showing beyond a question the great advantage of using thoroughbred males, and the care taken by this society in regard to pedigrees would indicate that the officers were alive to the importance of allowing no deterioration to be encouraged in the blood of these patriarchs of the herd.

Especially noticeable were the herd of beautiful Jerseys entered by Mr. Makie, of Great Barrington, showing in their fine points and

developments of milking-qualities great care and judgment in their breeding. There were also some fine grade cows of that breed.

In the hall the products of the dairy were well represented, showing that this section of Berkshire still retains its interest in this very important branch of industry, and showing that the farmers' wives have lost none of their old-time skill and appreciation of first-class butter and cheese.

The exhibitions of field-crops were numerous and excellent, and so was that of fruits and vegetables. The ladies were on hand, as they always are, with many articles of beauty and usefulness, which make the hall on these occasions a point of so much attraction to all.

I was able to attend only the first day's exhibition, and cannot speak personally of what took place the remaining two days, but am informed that the exhibition of horses was fully equal to that of former years.

WM. BIRNIE.

MARSHFIELD.

The annual exhibition of the Marshfield Agricultural Society was held at the society's grounds on October 2, 3 and 4, and as a delegate from this Board I attended the exhibition.

Marshfield has been celebrated and renowned for the past thirty years as containing the farm and residence of one of our country's greatest statesmen, one who threw his great mind into the scale of agriculture, and we are now reaping the benefits of his teachings and example.

I was agreeably surprised to find a cattle show, in the full sense of the term; the society full of enthusiasm, the officers devoted to their work, and their efforts appreciated by throngs of interested and happy people.

The first day, Wednesday, was devoted to the reception and arrangement of contributions, and the examination of committees to award the premiums.

The exhibition of cattle in the pens, although not large, was represented by Ayrshires, Devons, Jerseys, also their grades, while the stock called natives comprised the greater number.

Many good people, of a short range of inquiry, and a shorter range of reflection, imagine that the so-called native cattle are best adapted to all wants of the farm, ignoring the fact that specialties in the wants or use of cattle are as potent as specialties in the pursuits of man or in successful agriculture.

Marshfield is evidently benefited by the teachings and example of

her great Webster, whose farm was stocked with the most select oxen, and we found the exhibition of the town-team, numbering one hundred and five pairs of oxen, arranged in a long line on the track, an important feature of the exhibition. It was a fine sight to see so many well-matched oxen moving round the track, preceded by a band of music, while both oxen and their owners seemed to realize the dignity of the occasion in rendering their part a success.

Care is a price that all must pay who exhibit good oxen, and there is no reasonable doubt that the price was cheerfully paid by their appearance. There was also a considerable show of matched horses, draught-horses, driving-horses and colts.

The display of poultry was very fine, and the collection embraced the choicest specimens of almost every recognized breed, which were attractive and interesting even to a superficial observer, untouched even by the premonitory symptoms of the "hen-fever," while to the large class who keep fowls and desire to know something of the peculiar characteristics of the various breeds, the exhibition offered a very favorable opportunity.

On entering the hall, we were at once gratified with the display, —long tables loaded with useful and fancy articles in great variety that spoke well of the refinement and industry of the lady contributors. In the needle and fancy department the display was almost endless. The tables were laden with fruits, well worthy the efforts of practical horticulturists. The apples, pears, peaches, quinces, and grapes, were especially fine, denoting care in their cultivation; and we have often thought that poor success in fruit-culture is more often attributable to the want of proper care than any other want.

The bread, butter and cheese department was noticeable rather from the excellent quality of the contributions than a large display. One feature of this department struck us as eminently practical. The society requires that each contribution be accompanied with a statement detailing the process by which each article was made.

Flowers, somebody has said, "cheer the dusty path of toil." This department of the exhibition was particularly attractive, not only of the best varieties of flowers in their season grown out-doors, but fine plants in pots, as well as bouquets. And of cut-flowers there were some beautiful designs: one being a bell formed of flowers; another a white cushion with a red star in the centre, and most beautiful and fanciful hanging-baskets.

The vegetable department occupied nearly all the basement of the hall, and was represented by all the choicest varieties adapted to this climate, indicating a discriminating selection of seed and good care in their growth. The farmer who neglects his vegetable-garden

will find, sooner or later, that he is depriving himself and family of the many luxuries that their labor, well directed, would insure.

The society's dinner took place on Thursday, in the hall, and was all that could be desired upon such an occasion, every seat being taken. After which the company were entertained by an eloquent address by their worthy president, and speeches by the Hon. Marshall P. Wilder and the Hon. Albert Fearing, with a poem by Rev. E. Porter Dyer.

Again on Friday, after dinner, the society resolved itself into a farmers' meeting, to listen to an elaborate and instructive address by the Hon. Charles L. Flint upon successful farming in its several different phases adapted to Massachusetts.

The Marshfield society is using the means to promote successful agriculture, and its influence is beneficial to all departments within its scope.

The enterprise of building a dike, by which means the tide is prevented from flowing in upon a large area of land, one thousand four hundred acres, thereby rendering the land suitable for the growth of good grasses as well as a largely increased quantity, was started by the influence of the society. Successful farming, it must be understood, is not that which secures a large moneyed result immediately, but that course which insures to the land a constantly accumulating fertility.

O. B. Hadwen.

MARTHA'S VINEYARD.

The fifteenth annual exhibition of this society, was held on their grounds, in West Tisbury, October 2d and 3d, having been postponed one day on account of the session of the superior court at Edgartown, on the day appointed for the opening of the fair.

The very full report, made by your delegate last year, on the condition of this agricultural society, and the fact that owing to other engagements he was able to be present only on the last day of this exhibition, render it unnecessary to attempt a detailed description of what was seen by him.

No important changes have occurred since the last fair, except in the board of officers and such modifications in the general management as are usually connected therewith.

The ploughing-match was exceedingly well managed and well attended, though the ploughing was not remarkably good. The implements were old and poorly adapted to their work, the teams all required drivers and the soil was stony with a thin, weak turf.

The trial was however an interesting addition to the exercises of the occasion.

The show of stock was similar to that of last year. There were a few Ayrshire cattle, of fair quality, and many grades of the same breed.

The sheep and swine were few in number and of mixed breeds for the most part.

The poultry exhibited some peculiar features. There were ducks of three different crosses, viz. : the Muscovy and common domestic; the Rouen and the Mallard; and the common, with some wild species.

The Canada or wild goose was represented by a pair which had been in domestication fifteen years, and by a pair of their young, the first they have ever raised. It is very unusual for this species to breed in Massachusetts.

Among the fowls was a buff Cochin hen with an astonishing family of twenty-two chickens, reminding the observer of the old woman who lived in a shoe. The statement on the coop declared that this excellent mother laid twenty-two eggs, hatched every one and brought up every chick in the way it should go.

The exhibition in the hall was inferior in the display of vegetables and cranberries, but unusually good in apples, pears, peaches and quinces. There were forty-six plates of grapes, seventeen of peaches, eighty-two of pears, and one hundred and fifty-five of apples. Most of the varieties were without names, and therefore ought not to have competed for a premium. There were only a few entries of the cereals; but thirty-one of beans, which seem to thrive on the sandy soil of the island.

There were twelve entries of butter, and the quality was superior, but there was no evidence of cheese-factories.

On the whole the society appears to be in good condition, but really requiring the annual appropriation from the State to enable it to keep up its exhibitions to a creditable standard. There is almost everywhere a lack of capital employed in farming, and with the exception of the cranberry there is no agricultural product of special value. The price of land is however rising rapidly wherever it is suitable for building sea-side residences, and the rapidly increasing influx of summer residents promises to add materially to the valuation of the real estate and the business of the Vineyard.

The thanks of your delegate are due to Constant Norton, Esq., president of the society, to Dr. Peirce, a former member of the Board, and other gentlemen, for kind attention during his visit.

Wm. S. Clark.

MIDDLESEX.

The annual exhibition of this society was held at Concord, September 24th and 25th. This old society is still more vigorous and useful than many of its younger sisters. We went to Concord with high expectations, and we were not disappointed. During the past twenty years we have occasionally attended the exhibitions, and have always been pleased and well satisfied that this society was doing good service in the cause. The historic old town itself has many attractions, aside from the good show that is yearly offered to the people of Middlesex. This society is very fortunate in having within its limits some of the best market gardeners and fruit-growers in the State; those too who are willing to spend time and money to help make a good exhibition. It is particularly fortunate also in having officers enthusiastically devoted to its interests, who not only contribute of their time and energies, but who are always ready with an open purse. They practise as they preach. The arrangements for an exhibition are very good, the grounds extensive and the buildings admirably adapted to the purposes for which they were designed. Good order was everywhere observed, even though there were large crowds at times and places.

Entering upon the grounds on the morning of the twenty-fifth, a day favorable for such a gathering, our attention was first turned to the cattle-pens.

There were a good many native and grade cows, heifers and bulls, and many of them fine-looking animals, such as would have delighted the heart of the farmer years ago before we had obtained the more reliable pure-blood stock. We doubt not there were grade animals there that were even better, in some respects, than some pure stock that might have been selected, but we should not wish to rely upon them for breeding purposes. The show of Ayrshires was quite extensive and many fine animals were to be seen. We saw none on the field that we deemed more valuable to the farmer who is looking for quantity of milk of good quality, combined with size and beauty, that pleased us so much as the Ayrshires, and we think it will be difficult to find a breed better adapted to this part of the country for all purposes than this. We pass along to the sleek and pretty Jerseys, of which our friend Moore had some fine specimens. We admire these animals, and they have their place, not in the barn of the farmer or milkman, who are looking more perhaps for quantity than for quality, but in the stables of those who keep but one or two cows to raise milk, and especially cream for their own tables. For fancy animals we think they stand at the head of the list. We

would encourage the breeding of the Jerseys for the purposes for which they are so well adapted.

There were but few Dutch cattle, and those not superior animals. Herds of this and other breeds that we have seen in past years, were for some reason not present.

Few horses were on exhibition, except those that were in charge of the Jehus, who afforded much amusement for the crowd as they drove their fast nags around the track, a performance in which we took little interest. We do not wholly condemn this horse-racing, for when it is as carefully managed as it is by this society, there can be little of gambling or positive evil, while it cannot be denied that it affords much amusement to large crowds of people. We all admire the horse, with his noble qualities, and it is only fair to give him a prominent place in every cattle-show, but not to the injury of any other department. If there are those who cannot enjoy after-dinner speeches, or good music, and would prefer to witness a "purely agricultural horse-trot," why, just let them have their own way, if no harm comes of it.

A few good swine were shown, but we believe this department has never been a prominent feature of the exhibitions of this society.

There were fowls in large numbers and of excellent appearance, better in fact than we have seen at a cattle-show for some years. We are glad to see that more attention is being given to this branch of industry, for on witnessing the exhibition of fowls in the Music Hall in Boston last winter, we were fully convinced that immense improvement had been made during the last ten or fifteen years in breeds and breeding of fowls. If, then, so much has been accomplished, may we not feel encouraged to labor for still greater results?

In and about the society's building there was a good show of farming tools and machinery, so that the farmer, if he would, might compare one with another and possibly determine which it might be best to purchase.

The centre of attraction to a great many was the hall where was to be found, in great abundance, fruits and flowers from the orchardist and florist, as well as the handiwork of the fair daughters and buxom wives of old Middlesex, each of whom had contributed his or her share to swell the interest of the occasion.

The show of flowers, and especially of native flowers and plants, was certainly finer than we have ever seen before on a similar occasion, and we congratulate the officers of this society that they have been able to inspire their friends with such enthusiasm, that they are willing not only to grow flowers and plants in their gardens, but to seek, through field and forest, for the beautiful plants and flow-

ers that nature has with so lavish a hand strewn about them, to add to the enjoyment of all. We commend this spirit and hope to see it diffused through all ranks and classes of society.

There were many magnificent baskets of flowers that would have done credit to the tables of the proudest horticultural society of the world.

Finer fruit is rarely seen than was here found. The apples were remarkably good, reminding us of years gone by. Peaches and grapes were shown, of fine quality, and in considerable quantity. Our friend, E. W. Bull, Esq., exhibited fine seedling grapes, some of which, if we mistake not, are of great value. We shall watch them with interest.

In the vegetable department there was a goodly show, though we thought it not superior, if equal, to what we have seen there in former years. The ladies' department was well supplied and attracted the attention of many. We think the contributors are entitled to great praise for their successful efforts.

Specimens of butter, fresh from the dairy and good enough to please the most fastidious, were found upon the tables. But we can not take time or space to enumerate all the good things that contributed to make the show in the building, like that outside, a success.

The arrangements for dinner were excellent, and the tables bounteously supplied with comforts and luxuries pleasant for the eye to look upon, and good to the taste.

After dinner remarks were made by President Cummings, who is the right man in the right place, Judge Hoar, C. M. Hovey, Esq., and your delegate, which, with the music of the band, all contributed to make the occasion a pleasant, and we hope a profitable one. We left this old society with the feeling that it was well worthy of the State aid, that it had not outlived its usefulness, but that it had still a long lease of life, which we hope may be as useful to the county as the past years of its existence have been.

James F. C. Hyde.

MIDDLESEX NORTH.

Pursuant to appointment, your delegate visited Lowell on the 4th of September, 1872, purposing to perform the duties devolving upon him by virtue of your appointment.

It is hardly necessary here to say (what every member of this Board knows) that for the past two years the exhibitions of the

Middlesex North Society have been merged in the eighth and ninth annual exhibitions of the New England Agricultural Society.

It does not necessarily follow, however, that the interests of agriculture in Middlesex North have suffered by the temporary suspension, for a year or two, of the proper functions of its society. On the contrary, the most casual observer cannot fail to perceive that the exhibitions of the New England Society, held upon the grounds of the Middlesex North, have been beneficial in a great degree to the interests of the Middlesex North Society, for hither have been brought for two successive years the choicest specimens of the varied products of agriculture. Not only New England, but the agricultural and horticultural interests of many States outside of New England, including those on the Pacific slope, have contributed the finest specimens for the benefit of the New England Society. These advantages and opportunities for observation have been especially enjoyed by the farmers of Middlesex North.

Neat stock, representing the most famous breeds of the country; horses without number, from the finest thoroughbred for speed, to the slow, reliable cart-horse; agricultural machinery and implements of the most improved construction; the products of the soil in cereals and vegetables; horticultural products innumerable,—all these have been brought to the immediate observation of the agriculturist of Middlesex North, stimulating him to renewed exertions to elevate the standard of excellence in the various departments of the exhibitions to be held hereafter by his local society.

The State of Massachusetts has wisely made provision by which the several societies within her limits, conforming to her requirements, shall be the recipients of her aid and bounty. The purpose of the enactments authorizing and granting aid to the agricultural societies of the State is to secure and disseminate valuable information in the interests of agriculture throughout the State. It therefore behooves each and every society, the recipient of this aid, to conform as nearly as may be to the requirements of the laws made by which they receive aid from the State.

EUGENE T. MILES.

MIDDLESEX SOUTH.

In more ancient days, when children complained of inhospitable rains which interfered with their sports, they were referred to the clerk of the weather, and now the clerk has descended from his misty heights and located at Washington, but although more accessible to our demands, pays as little heed to them and dispenses

sunshine and showers in what to us seems fitful recklessness, and this year made the weather for most of our exhibitions intolerable for the crowds of anxious sight-seers, and decidedly unpropitious for the treasuries.

No exception was made in behalf of the fair of the Middlesex South, held at Framingham September last, though it might naturally have been supposed that the genial efforts of its accomplished president, Geo. B. Brown, Esq., and the energy of Jas. W. Brown, its secretary, would have projected all sorts of blessings, and had the weather-clerk been in my place, a guest of the president, he would hardly have dared to recompense his hospitality by the unkind profusion of rain which turned the track into a canal and caused the whole enclosure to look like a skating-rink with the ice off, or a Coliseum partly submerged for an exhibition of aquatic sports.

But not even bad weather could prevent a small but choice show of thoroughbred stock, the Ayrshires of Messrs. Sturtevant leading off, followed by the Jerseys of Messrs. Bowditch, Ellis and Moulton, with a sprinkling of Dutch and Guernsey. There was also a fair display of native cows, working oxen, extra fat hogs, and an excellent show of poultry, in about one hundred coops.

The hall was finely decorated with flowers, and the tables groaned with fruit and vegetables of every sort; the silver medals for the best assortment of each going to Framingham cultivators. Bread, I was glad to see, was a specialty, and there were some really good specimens of brown bread, but dairy products were on a small scale.

The equine race came out in full strength and speed (as did the human in a fireman's foot-race), and had the exhibition no other special feature, that of the attractive one of horses was sufficient to draw a good Yankee crowd. The stallions, farm-horses, roadsters, family horses, matched pairs, and mares with colts, were all worthy of the place, and did credit to their owners, and there would seem no more fitting place for the display of this noble animal and his qualities than at our annual agricultural fairs.

The dinner was of course excellent, and the speeches short and lively, and notwithstanding the cold and lowering weather, with assortment of rains, the nineteenth annual exhibition of this society was in all respects a success.

R. Goodman.

NANTUCKET.

The matter of reaching Nantucket from the Connecticut Valley in the latter part of the month of September is no trifling affair, if one reckons his time and patience as of any value. At the start. time-tables and railroad officials make the trip seem simple enough, yet it becomes pretty complicated before he reaches the end of his journey. The first day's ride and sail brought your delegate within the base-lines of a camp-meeting ground, instead of the precincts of a cattle-show and fair. Twenty-four hours or more were spent in viewing the beauties of Oak Bluffs, and meditating upon the real value of 7 by 9 lots, held by land-speculators at fabulous prices, the intrinsic value of which must be placed on the measurement from the sand-heap skyward. A patient waiting and another steamer brought the anticipated relief. Your delegate, on his arrival at the wharf in Nantucket, was met by the president of the society, Mr. Myrick, in waiting to take him to the fair-grounds, which are located about a mile from the landing. The pleasant attentions and cordial hospitalities rendered by the officers and members of the society made ample amends for the annoyance of road and sea.

A survey of the grounds (which are ample for the society's use) brought to view some more than two hundred head of neat cattle, several flocks of sheep, a few swine, and a goodly display of the several varieties of poultry, including geese, ducks, turkeys, Guinea fowls, and barnyard fowls of approved breeds and families. Going from, and representing a society whose members pride themselves on their large cattle by the ton, he was somewhat prepared to make allowances for any apparent deficiencies in the quality or quantity of the stock-department. He was agreeably and pleasantly disappointed. His introduction and conversation with the members of the society soon assured him that he was in a live society, as well as among the live-stock.

Very little of the Shorthorn family was represented. Looking over the face of the country, and the actual needs of the islanders, your delegate thought he could understand why that class of animals was not more abundant. It would be conceded by any good breeder that the herds of the Andersons, Wellses, and Carpenters. of Shelburne, would stand small chance of making a good show on pasturage grown upon the gravelly, sandy plains of Nantucket, after herding for years upon the heavy clay and limestone soils of Franklin County.

The tendency of the island cattle-growers is toward the Ayrshire and Aldeney stock. Yet cattle of those breeds are sold at quite

moderate prices. All families and breeds of cattle were represented by individual specimens, from the broad, long-horned ox to the no-horned Galloway, which seemed quite common, while the society guarded its interests by offering no premiums on grade bulls. One pair of oxen was particularly noticeable for their immense horns. It really seemed to your delegate that they were pretty much all horns. If the city of Jericho was compassed round about by a body of soldiery competent to blast with that sort of horn it is no wonder that the adobe walls of the city crumbled before the blast. The only practical lesson which could be drawn from a view of those horns, was, that if the soil of Nantucket could produce many such, no need of further applications of bone-dust and nitrogen to that country, and agents for the sale of patent manures and special fertilizers should shun the island.

Mr. Manuel Enos (a native of Portugal, but seemingly a live native Yankee), was the largest exhibitor of thoroughbred stock in a herd of Ayrshires. If he prosecutes the continued breeding of cattle with as much enthusiasm as he manifested on the fair-grounds, his herd will eventually become famous. It already contains some fine animals. There were no other full herds of thoroughbreds, but some of high grade and native stock.

Several yokes of working-oxen would do credit to any society's exhibition, and make a good show in the cattle-stalls of the Connecticut Valley beef-feeders. The cows were in large numbers, many of which were of high grades. The samples of butter, afterwards examined in the hall, which were exhibited by Messrs. Austin, Burgess, Enos, and others, would pass for "gilt-edge": proving that butter might be, if not already, made a staple article of commerce from the island.

In the evening the members of the society, with their families, gathered socially at the hall of the Athenæum, where were also gathered the varied products of their summer's industry. To particularize what was meritorious in the hall would exceed the limits that should be taken for this report. The collections of vegetables made by Messrs. Hiram C. Folger, Charles A. Burgess, F. H. Folger, Levi S. and Henry Coffin, were excellent. The cabbage-family was the only failure. That crop on the island, as in many other portions of the State, was damaged by the moth.

Fruits were also good. Some of the finest specimens of pears seen during the year were on the tables at Nantucket, including the Flemish Beauties, Bartletts, Beurre Clairgeaus, Clapp's Favorite, Seckels, and other choice varieties. There were two contributors of grapes, under glass (Messrs. Alley and King,) and three only of out-door grapes. The fruit of each looked well-grown and inviting.

Apples were not abundant. There were sufficient quantities and varieties to show that the islanders can be supplied from their own soil. Samples of Indian corn, pop-corn, potatoes, melons, squashes and oats were surprisingly fine.

The hall was tastefully ornamented with the handiwork of the ladies, not excluding the usual patch-work bed-quilt, and some mechanical craft of the men.

Your delegate was too late to see the ploughing-match, and too early to attend the horse-trot. The pressure of business matters connected with his own county fair compelled his early return, leaving that part of the Nantucket show to take care of itself, well knowing that it needed no stimulus from delegates to make it attractive. The public journal of the island represents it as a success.

The question might naturally come in here, "Does the society need the stimulus of the state bounty; or is the state bounty well expended?" The answer in the mind of your delegate would be, "Yes." One familiar with favored localities for fruit and vegetable growing on Long Island, in New Jersey and the banks of the Hudson, could not resist the conclusion that with proper facilities for getting to market, and a well-directed energy thrown into the business, the residents of Nantucket ought to compete successfully with the outside world in supplying Boston and other markets with fruits, vegetables, and large quantities of good butter.

If tomatoes and small fruits can be sent with profit from Philadelphia by the steamboat-load, with equal ease and less time by several hours they can be sent from Nantucket.

A friend of the writer, each year sends his crop of strawberries from an inland town, on Long Island, to Boston markets, and is fully satisfied with the returns of sales. What should hinder a Nantucket farmer from doing the same in six or eight hours' less time? If an afternoon-boat from Nantucket and a night-train from Wood's Hole could be attached to the state bounty your delegate is of the opinion that more rapid progress would be made in the agriculture of Nantucket. In comparison with many other farming districts in the State, it has many favored elements of success in the way of securing fertilizers from the sea and sea-shore, a milder winter climate, a longer season for farm labor, and an easy soil to work, with the prospect of an enlarged home market for everything the soil will furnish, caused by the influx of summer visitors and residents, who, if welcomed by the usual hearty Nantucket welcome, and such as was extended to your delegate, will often repeat their visits.

A. P. Peck.

NORFOLK.

The twenty-fourth annual exhibition of the Norfolk Society, was held at Readville on the twelfth and thirteenth days of September, 1872. The weather that made such fair promises on the morning of the first day, soon changed its mind and gave us what you might call "catching weather." On the second day it was even more so, and the pouring rains destroyed the hopes and expectations of those who had labored hard to make this one of Norfolk's most successful exhibitions.

The show, nevertheless, was very creditable to the society; the best since its removal from Dedham. The show of stock was large and of very superior quality, a large proportion being thoroughbreds. Of horses there was a fine display, prominent among which was the splendid stud of Colonel Russell, the president of the society.

The show of swine was excellent, and the poultry was splendid.

Owing to the show being held one or two weeks earlier in the season than usual, the display of vegetables was not as good or extensive as usual.

The display of fruit was large and of excellent quality. Hon. M. P. Wilder's extensive collection of pears was there as usual, but not for premium. F. and L. Clapp, H. P. Kidder, C. B. Leavitt, W. B. Kingsbury, T. Lyman, C. F. Curtis, J. W. Brooks, Benj. Mann and G. S. Curtis had fine collections. Apples, peaches and plums graced the tables and were creditable to the contributors.

Flowers were in great profusion, and the display was most beautiful.

In the department of ladies' work the display was the best made for many years. The straw-goods exhibited by Carpenter, Cook & Co., of Foxborough, attracted great attention.

Bread and butter was unusually good,—the butter being of marked excellence. A. W. Cheever, of Sheldonville, James R. Fisher, of Norwood, James M. Codman, of Brookline, Henry M. Mack, of Dorchester, and Mrs. Longfellow, of Needham, took the prizes.

Stoughton took the prizes for cheese.

The departments of domestic manufactures and agricultural implements were not crowded with machines or implements.

The ploughing-match took place Thursday at ten, A. M., and drawing-match at eleven, A. M., and the exercises at the track commenced at two o'clock, P. M.

Friday there was a grand cavalcade and trotting, fully employing the time when the rain would permit.

The dinner and address were given under a new and spacious tent on the grounds, Col. Russell, the president, presiding. Speeches were made by the president and the honorary president, the Hon. Marshall P. Wilder, enlivened by the music of the Dedham brass band, and by singing by the Canton quartette club.

The Hon. Albert Fearing, your delegate, was prevented from attending by ill-health. By request, the above notes were taken by a gentleman present at the exhibition.

PLYMOUTH.

The annual exhibition of the Plymouth County Cattle-Show was held at Bridgewater on the 26th, 27th and 28th of September.

The first day of the fair was emphatically rainy. On the morning of the second, the windows of heaven were wide opened, and notwithstanding the rain came down in torrents, at nine A. M. I put in an appearance at the gate of the fair-grounds. I very unexpectedly found the entrance guarded by a man apparently anxious to commence the business of taking tickets. I showed my passports and was readily admitted to the grounds, and forthwith to the hall. Though the few people who were within were strangers to me, I felt perfectly at home. I had ample room and time to examine in detail the very large and excellent display which filled the room to its utmost capacity.

The hall is located on an eminence, and its windows command a view of the surrounding grounds, which, on that particular morning, were completely flooded. As I surveyed from the windows the empty cattle-pens, the deserted track and tents, I thought of the anticipated pleasures that had centered on that day, and the fond hopes which that unpropitious day had blighted; that cattle-shows should be held on the next fair day, "if the weather prove stormy," appeared to me the most reasonable thing in nature. I admired the wisdom and foresight displayed in locating that hall on a hill, and had no doubt but that a prophetic eye had seen that very morning.

At this point my meditations were broken off by a woman who stood gazing at the next window, holding a child, and singing in a subdued tone,—

"On Jordan's stormy banks I stand."

The exhibition in the hall was as I expected, full and excellent. The specimens had evidently been selected with great care, and arranged with good taste. Some idea of the appearance which the fruit-tables presented may be formed from the fact that there were thirty-three entries of apples, filling four hundred plates, twenty-five of pears and twenty-three of grapes. Agricultural products and products of the dairy occupied extensive table-room.

In the floral department we were somewhat disappointed,—the limited display, consisting chiefly of cut-flowers and a few bouquets. There was a good show of bread, pastry and preserves, and fancy articles were too numerous to mention. The display of musical instruments, manufactured articles, agricultural implements and machinery filled up all the available space in the hall and added much to its attractions.

As before intimated, the cattle-pens were deserted at the close of the first day. We learned, however, that they had been well filled with about two hundred head of neat cattle, making the best show in this department ever made by the society. We learned that the ploughing-match of eight ox-teams and of seven horse-teams was spiritedly contested, and evinced great skill on the part of the ploughmen. We also learned that prominent among the attractions on the track had been a trial of fast-walking oxen, five yokes competing for the prize, and the winning pair making the half-mile in seven minutes and fifteen seconds.

This is one of the oldest, and in some respects, one of the best managed societies in the State. Though somewhat in debt, they are not in the least discouraged. They have expended during the last year about three thousand five hundred dollars in the erection of cattle-sheds and an imposing gateway, the latter quite an ornamental structure, and the former very useful and convenient.

I was told that the society was dissatisfied with the days which this Board had assigned them for holding their fair. Whatever change, if any, the Board may decide to make in this respect, let us earnestly hope that two such exhibition-days as the 26th and 27th of September last, may never again fall to the lot of the Plymouth County farmers.

A. P. Slade.

UNION.

On the 19th and 20th of September the annual Cattle-Show of the Union Agricultural Society was held at Blandford. The morning of the 19th opened with a severe rain-storm. The sturdy New England character of the people of this hilly region met it with such

spirit and energy as at once to insure the success of the fair. They were determined that the wet, cold storm should not chill their interest in an enterprise whose aim was to benefit the people of that vicinity.

The women were as spirited and as ready to meet the frown of the elements as the men. They gave, from first to last, all the influence of their presence and courage to make the gathering pleasant and profitable.

As the Board are aware, this society covers a territory where the distance from market and the character of the country encourage the raising of stock. The show, though in this respect not extensive, gave you the assurance that the stimulus of cattle-shows and the extended information of the principles of breeding, had already produced a healthy effect upon the farmers of this region. Even native stock was better bred than formerly. The improved breeds evidently were receiving the chief attention. The Durham breed, shown in some very fine working-oxen, evidently flourishes well here. Rarely have we seen better proportioned animals and finer specimens for obedience, beauty and strength. Some fifteen entries for drawing presented us with the skill in training, the kindness in using, and the almost marvellous power of these patient servants of man.

The sleek sides and fine forms of the fat cattle told us of beef that must be tender and sweet, fattened on the sweet grasses of this region, and well worthy the best markets. Here, as well as all through the line of neat stock, the quantity was not large, but the quality very good indeed. The last remark anticipates me in saying there was an indication of a good deal of effort made to improve their neat stock, and this we trust is an assurance of still greater effort in future. Where grass and hay are abundant, we should look for the greatest improvement in stock.

The dairy, also, was most beautifully represented by butter of the finest color and taste, and by cheese of a good quality. This part of the exhibition confirmed our judgment concerning the good quality of the cows exhibited. The statistics concerning the produce of some of the dairy-animals were clear and concise.

One cow during the year made over three hundred pounds of very fine butter, if equal to the sample shown, and fatted a twelve-dollar calf. Another made a pound of butter per day from five quarts of milk.

The horses are being improved by the Hambletonian and Morgan blood. A large display of breeding-mares and fine colts gave evidence to the interest now taken in the improvement of this fine animal.

The hall presented a good display of apples, pears and grapes. There was a table of vegetables, some fine, but on the whole rather meagre in quantity.

As usual, the numerous articles from the hands of the ladies showed not only their skill and industry, but also their interest in the fair.

Another feature of this fair attracted our attention. On the evening of the first day of the fair, the farmers and their wives and daughters gathered at the church for a social meeting. It opened with very good music. Then some of the sons, who had been away from the farms and native hills following a profession, entertained and instructed the audience. They came back to say to the young men, though they would find more excitement abroad, yet, in their opinion, less happiness was enjoyed, and less real success, than upon their native hills.

In our opinion the influence of this society is to increase a knowledge of agriculture, and especially to awaken and stimulate a laudable ambition among the farmers and their wives to excel in the management of a farm.

In closing, allow me to express my thanks to the officers of this society and the delegate of this Board, residing at Blandford, for the unremitting attention and open hospitality shown during my visit.

WM. KNOWLTON.

WORCESTER.

As delegate from this Board, we visited the annual fair of the Worcester County Agricultural Society, September 19th and 20th, 1872.

Leaving Boston in the forenoon of the first day in one of the hardest rain-storms we remember to have experienced, we arrived at the "heart" of the Commonwealth and on the ground of the society about two o'clock, P. M., in time to witness the intellectual part of the annual entertainment at the hall. We think the social advantages which are particularly secured at the annual dinner are by no means the least important benefits derived from our fairs.

Leaving the hall at the close of the exercises—the clouds of the morning having given place to genial skies,—we found that despite the torrents that poured in the earlier part of the day, the farmers of Worcester County had not neglected their annual festival, but were present themselves, their sons and daughters, with the products of their farms, the cattle from their hills, not excepting the sheep, swine and poultry.

The ploughing-match had taken place in the morning, but the furrows gave evidence of the skill with which this important part of husbandry was performed. About a dozen teams contested for the supremacy.

As one would infer from the fertility of the lands of Worcester County, the great feature of the exhibition was the fine herds of cattle that filled their pens to overflowing, many being tethered to the enclosure. The choicest breeds were well represented, both in quality and numbers, several herds of each distinct class being present, competing for the large premiums which this society so liberally offers.

The other departments of the exhibition were generally good. If there was a deficiency in that of fruits and vegetables, it was more than made up at the horticultural exhibition held in the city, and distinct from that of the society.

Pardon us for suggesting whether it might not be better for both societies that their exhibitions do not occur at the same time.

The second day was all that could be desired to insure success.

As with so many other societies, this day was entirely set apart for an exhibition of the horse: and although twice the ordinary fee —or fifty cents—was charged for admission to the grounds, yet the multitude who thronged the enclosure in the afternoon indicated the deep interest felt in the exercises then to take place. We believe the programme was carried out to the entire satisfaction of all.

May we not hope that the time will come when the products of the soil, from whence the whole family of man so largely derives its sustenance and support; when the skilful handiwork of the matron and the lass, without whose refining presence life would be a waste, and civilization again relapse into the barbarism of the past, shall be as potent to attract and awaken as lively an interest as the excessive speed of that noble animal, the horse.

Although this is one of the oldest societies in the State, we perceived none of the imbecility of age. The good order that prevailed was noticeable throughout the fair.

We shall long remember the kindness of Mr. and Mrs. O. B. Hadwen who took us to their pleasant home, anticipating our every want, and thereby enhancing our pleasure on that pleasant occasion.

GEO. M. BAKER.

WORCESTER NORTH.

The twentieth annual exhibition of this society occurred on the society's grounds at South Fitchburg, on Tuesday and Wednesday, September 24th and 25th. 1872.

The society was highly favored with pleasant weather during both days of the fair.

On my arrival, I was welcomed by the president of the society, Hon. J. H. Lockey, and shown through the halls of the building and over the grounds of exhibition. The society have ample grounds and buildings well located.

The lower hall was devoted to the mechanical display, with power to operate the different machines, presenting quite a busy and attractive scene when all in operation, and forming an important feature of the exhibition. Stoves and other heavy articles were shown on this floor.

The upper hall was occupied with the display of fruit, flowers, vegetables, fancy-goods, and articles of lighter manufacture. In this department there was a very fine display of fruits and flowers. Among the more prominent contributors of grapes were Drs. Fisher, Brigham, Palmer, Jewett, and Messrs. Walter Heywood and E. T. Miles. There was a good show of pears and apples. J. M. Sawtell led off with a very extensive show of various kinds of flowers in pots. Sylvanus Sawyer also made a very fine display. I think I never saw at any country fair so extensive and varied a display of flowers as was here exhibited.

The show of vegetables was very fair, although not so extensive as I have seen. The bread and butter proved that the ladies knew how to make a fine quality of each.

Gen. John W. Kimball acted as chief marshal, and under his supervision at ten o'clock, according to programme, the ploughing-match took place. Eight spans of horses and three yokes of oxen competed for the premiums of speed. The grounds were not as good as might have been desired for a contest of this kind. After the assignment of the plot of ground to be ploughed by each team, the word was given to start, and all, both old and young, went at it with a will, each holding his plough and driving his team at the same time. The eagerness of all to excel added much to the interest of the owners as well as the drivers of the teams. I saw nothing during my stay on the grounds that was more attractive and interesting to me; in a word, it was grand. An agricultural ploughing-match (if I may be allowed the expression), and an agricultural horse-trot, should go hand in hand. It is not the track, but the manner in which it is conducted,

which causes distaste on the part of many to trying the speed of horses at agricultural exhibitions. Pool-selling and betting should be discouraged. We all, as farmers, wish to see the strength of the ox and the speed and power of the horse.

At ten and a half A. M. came the trial of working-steers; at eleven and a half the exhibition of town-teams. Leominster, the home of the president, led off with seventeen yoke of oxen. It is always an agreeable sight to the farmer to see a good display of working-oxen.

The show of stock was good, Capt. E. T. Miles leading with a splendid herd of Ayrshires, and Augustus Whitman, Esq., with a fine herd of Shorthorns, both of which are well known as the herds which took the premiums at the New England Fair, as well as at several others. J. F. Brown had a herd of Jerseys, some of which were very good. The show of stock outside of the herds mentioned was not large, although there were other smaller herds on the grounds, belonging to G. L. Rice, L. Nichols and others.

There was a large show of swine. The fat pig, weighing 864 pounds, was exhibited by C. C. Boyden, of Leominster.

The poultry department was well supplied with some fine specimens of fowls.

The display of agricultural implements was rather meagre.

At twelve o'clock dinner was served in a large tent in front of the building. This was an interesting feature in the exercises of the day. Dinner being served, the president, J. H. Lockey, Esq., introduced the Rev. C. W. Emerson, the orator of the day, who delivered a very instructive address, upon "The Relation of Agriculture to Manhood."

The programme for the afternoon consisted of the trial of working-oxen, steam fire-engines, and a foot-race. The agricultural merits of an exhibition of steam fire-engines I leave for others to describe.

My engagements were such as prevented me from remaining with the society during the second day of exhibition, which was taken up with a trial of draught and working-horses, and in the afternoon there were trials of gentlemen's driving-horses. Between four and five o'clock, the balloon "Aurora," under the supervision of Professor S. A. King, started on its aerial voyage, guided by W. S. King, son of the professor, being his second voyage of this kind. The trip was successful and satisfactory.

I would here acknowledge my obligations to Hon. J. H. Lockey and lady, and also to E. T. Miles, Esq.

J. Ladd.

WORCESTER SOUTH.

In compliance with the appointment of this Board I attended the eighteenth annual fair of the Worcester South Agricultural Society, held at Sturbridge, September 12th and 13th, 1872.

The weather on the first day was very favorable, and I found the farmers wide-awake, with their wives, promptly at work, and manifesting a desire to make their fair a successful one.

First came the ploughing-match, in which were engaged twelve ox-teams and two horse-teams. Not getting on the ground in season I witnessed but a small part of it: but judging from what I saw, there was considerable competition and the work well done.

The show of stock was not large, yet there were some excellent specimens of Shorthorn heifers on the ground, and also a five-year old bull, owned by Mr. Dwight, of Dudley, which was one of the finest animals of the kind that it has ever been our good fortune to see.

Of sheep and swine there was a fine show, with some good specimens among them.

The show of poultry was quite small, but the quality made up somewhat for the meagreness.

The second day of the fair, devoted to the show of horses, was very rainy, so much so, that after a part of the programme had been gone through with, it was thought best by the officers of the society to postpone that part of it. So far as gone through with it was commendable.

Of the thousand-and-one articles in the hall, there was a fine exhibition. Fruits of all kinds were there in abundance: also vegetables, and the various productions of the farmers and their wives.

In the ladies' department there was a full display of the productions of the dairy, in lumps of golden butter and cheese that were good to look at, to say the least. There was a full display of fancy articles, and in all parts, I may say, wherever the ladies were concerned, there was no lack of articles.

One thing that particularly attracted my attention was the good order that prevailed in and around the grounds throughout the exhibition.

I would here tender my thanks to the officers and other gentlemen of the society for their efforts to make my visit with them pleasant and agreeable,

NAHUM P. BROWN.

WORCESTER SOUTH-EAST.

By assignment I was to have visited and reported the Worcester North-West Agricultural Society at Athol, but through arrangements made between Messrs. Knowlton, Fay and Leavitt, at the request of Mr. Knowlton, I visited the Worcester South-East at Milford, September 24th and 25th, 1872. Arriving at Upton, the home of Mr. Knowlton, the afternoon of the 23d, some time was taken in showing his farm improvements, which a large proportion of the farmers of Massachusetts could accomplish, had they the will, in the reclaiming of swamps and making the rough places smooth. Mr. Knowlton has here worked with good present-paying profits, which in the future will continue to pay large dividends, and to any who wish to learn relative to reclaiming land, I say visit Upton and view the many acres Mr. Knowlton owns; and the valuable information on this subject he can give would be more than could be comprehended by reading weeks the many treatises on this subject. For myself I feel under great obligations to him for the very valuable points of information he gave me; but it is not for me to speak in this report of affairs in Upton, but of the thirteenth annual exhibition of the Worcester South-East Agricultural Society.

The morning of Tuesday, the 24th of September, dawned under the most favorable of circumstances for a farmer's holiday, being neither too warm or too cold,—in short, a perfect day. As I entered the spacious grounds of the society, formerly the "Park of the Charles River Riding Association," I found the usual activity and stir in the organization of the exhibition. Punctual to the hour of commencement of exercises, the Hopkinton band arrived, to furnish music for the occasion. The stock calling my attention, I found the many pens were well filled with cows, heifers, bulls, fat cattle, &c., &c., among which were seen many thoroughbred animals.

The show of bulls was very fine, ten in number—two Ayrshires, three Devons, and five Jerseys. Prominent among the herds was the Ayrshire and Jersey herd of our friend Knowlton, and the Devon herd of Harvey Dodge, of Sutton,—the last for exhibition but not for premium; in this herd I was shown one cow that had received over five hundred dollars in premiums. To make the first day attractive to all, some classes of the horses were brought out. The stallions, seven in number, were of the best stock in the country (Hambletonian, Morgan and Ethan Allen).

The carriage-horses, breeding-mares, and colts, were of the very best. The "Ladies' Driving" class subscription purse, was a novelty to me, as I think to many, but gave a chance to witness one

of the best races I ever saw. The two horses in the three heats were neck and neck, and made time, 3.03, 2.54, 2.54. The remark was made to me, by an old horseman, that these lady drivers could not be equalled in the country.

The class for horses trotting nearest to 3.30 in three average heats, made much excitement. Fourteen horses contested here for the premium.

The poultry, consisting of some seventy coops, called a large attendance of admirers at all hours.

Only two pens of sheep were seen, while swine were presented by eight exhibitors, many of the swine very fat and showing good feed and breeding.

Finding the day drawing to a close, I accepted the kind invitation of one of the officers of the society to make his house my home while in Milford, and awaited the second day, which was bright as the first.

The ploughing-match was first in order of the day; I found twenty-one competitors, nineteen of oxen and two of horses. A large crowd was in attendance and much interest was manifested, and passed off very successfully and satisfactorily.

The trial of working-oxen and steers was the centre of attraction while in progress, and showed the power of the ox for work, yet I think the test was too hard, and some whipping allowed, which I think the society should not encourage or countenance.

The exhibition of trained steers was excellent, and showed the amount of intellect our cattle develop by careful training and teaching.

The annual dinner, this day, was made one of the attractions, and the large dining-hall of the society was filled; it was an interesting as well as successful affair. After all had pronounced their eulogy on the rich provisions so bountifully provided, the president of the society, Mr. Knowlton, called all to order, to listen to an original poem by Mr. A. Green of the "Springfield Union," followed by remarks of an hour's length on the science of agriculture practised among the Romans, all closing with an original poem by Hon. G. W. Holmes of Uxbridge. The remainder of this day, as well as the third day, was devoted to horse-trotting, and passed off harmoniously and pleasantly to all, and I pass it by as all very good to report. The hall was filled to overflowing. I think I never saw a display of articles more numerous and tastefully arranged: vegetables of all kinds in large quantities, mammoth squashes, beets, &c., all telling the beholder what the soil of Worcester South-East. by careful culture, can produce in abundance and size.

Fruit of all kinds, in endless profusion, held out temptations for

one to linger long examining the fine specimens crowning the full tables devoted to it.

Canned fruits in large quantities and in fine condition, gave one to understand there were many here who believed in laying by the bounties of summer and autumn for the cold winter to come.

The floral display was large, and much credit is due the committee under whose charge its splendid arrangement was made.

The exhibition of fancy articles, paintings, artificial flower-work, domestic and household manufactures was extensive, and was an attractive point to all.

Milford being a boot and shoe manufacturing town, I expected to have seen this department very full, but noticed specimens only by Geo. B. Blake & Co. and C. B. Godfrey & Co. The boots and shoes, by Messrs. Blake & Co., especially, were of the highest class of workmanship and quality.

Cloths and furnishing-goods were shown in large display, by two of the leading business firms of the town.

Butter and cheese I found in limited quantities, but all very nice. One plate of butter I noticed in particular, "sample of 336 pounds made from two cows since the first of May" (or less than five months).

Photographs, telegraph instruments, sewing-machines, melodeons and organs, stoves and house-furnishing goods, furniture, mowing-machines, horse-rakes, cultivators. &c., had their allotted positions and attention.

To the worthy president, our associate on this Board, and other officers of the Worcester South-East Agricultural Society, I am under great obligations for the attention and courtesy shown me, and shall ever retain pleasant memories of my visit to this society.

ENOS W. BOISE.

WORCESTER WEST.

The annual exhibition of the Worcester West Agricultural Society was held in Barre, September 25th, 1872. The morning was dark and wet.

Notwithstanding the rain, the attendance at the grounds was good. The show of stock was fair, both of grade and blooded; some were very fine. I was told that the Shorthorns were thought to be better than formerly. There were some very nice oxen and cows; a few of them were rather extra. A small herd, owned by Dr. Brown, of Barre, were very fine stock. Also a herd of over twenty head of grade stock, entered by John T. Ellsworth, would be considered an honor to

any show. The two yokes of oxen owned by John Sanderson, of Bernardston, attracted the attention of the people. The first pair was marked,—age six years; weight, 6,000 pounds. The second,—age seven years: weight, 7,000 pounds. They were handsome and well proportioned. The pens were well filled with grade stock, and it was a matter of careful study to decide which was best.

The show of swine was quite commendable. The sheep department was not very largely represented, though there were some good cossets.

The show in the hall was the best,—vegetables, butter, cheese (domestic and factory). The bread, cake, fancy articles and the fine arts, from the hands of the ladies, could but be admired by all.

Various kinds of machinery, agricultural tools, &c., were on exhibition, in numbers which could but satisfy the minds of all present that they had succeeded in having a good show.

I know of no better way to show the interest manifested by the friends of the society than to say that more than three hundred were seated at the tables at dinner.

After dinner, Rev. Wm. H. H. Murray, of Boston, gave a short address upon the "Training of Cattle," which was valuable and interesting to all present. A few off-hand speeches from others followed, and the multitude left for their homes.

The 26th was so wet that the horse-show was adjourned for two weeks. The report says they had a good show.

HIRAM CONVERSE.

RETURNS

OF

AGRICULTURAL SOCIETIES,

FOR 1872.

7*

FINANCES OF THE SOCIETIES.

SOCIETIES.	Amount received from the Commonwealth.	Income from permanent fund.	New members & donations.	All other sources.	Receipts for the year.	Prem's offered.	Prem's and gratuities paid.	Current expens's for the year—not including premiums and gratuities.	Disbursem'ts for the year.	Indebtedness.	Value of real estate.	Value of personal property.	Permanent fund.
Massachusetts,	-	$3,216 32	$340 44	$6,506 14	$10,062 90	-	$3,794 00	$605 11	$4,399 11	-	-	$66,075 92	$66,075 92
Essex,	$600 00	1,187 38	194 00	1,199 00	3,180 38	$2,420 00	951 00	2,685 29	3,636 29	-	$8,000 00	14,365 26	21,365 92
Middlesex,	600 00	-	816 00	2,408 26	3,824 26	2,197 00	1,449 00	1,650 82	3,099 82	$14,000 00	25,000 00	1,000 00	12,000 00
Middlesex North,	600 00	-	668 00	-	6,326 75	-	3,500 00	2,216 90	5,216 90	1,000 00	25,000 00	300 00	24,300 00
Middlesex South,	600 00	-	74 00	3,173 00	3,847 00	2,197 75	1,573 00	1,807 33	3,115 00	12,500 00	18,000 00	-	5,500 00
Worcester,	600 00	-	85 00	5,073 58	5,758 58	2,580 75	2,160 48	3,063 64	5,224 12	28,500 00	125,000 00	1,000 00	96,500 00
Worcester West,	600 00	200 00	363 00	1,394 32	2,557 32	1,909 25	1,474 95	1,137 34	3,192 28	3,131 00	13,700 00	820 02	10,569 00
Worcester North,	600 00	-	115 00	6,051 17	6,766 17	2,407 00	913 62	5,603 53	6,517 15	10,000 00	16,000 00	50 00	6,000 00
Worcester N. West,	600 00	-	261 00	3,490 68	4,351 68	1,598 00	1,275 00	1,918 41	4,293 41	10,522 47	15,300 00	1,700 00	6,477 33
Worcester South,	600 00	2,400 54	113 00	1,477 76	4,591 30	1,202 50	987 90	2,935 66	3,223 56	6,700 00	12,800 00	1,500 00	7,600 00
Worcester S. East,	-	221 00	158 76	2,067 51	2,447 27	1.565 75	835 37	1,485 49	2,320 86	10,600 00	15,000 00	1,000 00	5,400 00
Hampshire, Franklin and Hampden,	600 00	-	129 00	7,874 19	8,603 19	1,009 75	921 60	1,977 66	8,617 78	5,800 00	12,500 00	500 00	7,200 00
Hampshire,	600 00	-	55 00	1,154 01	1,809 01	1,145 00	667 80	794 29	1,764 41	1,350 00	6,000 00	-	6,000 00
Highland,	600 00	97 80	42 00	699 25	1,439 05	740 00	626 75	812 95	1,440 20	44 40	3,000 00	1,300 00	4,300 00
Hampden,	600 00	-	1,055 00	3,981 97	5,636 97	1,506 50	657 12	4,943 80	5,600 92	24,000 00	35,000 00	-	11,000 00
Hampden East,	600 00	-	349 00	253 32	1,202 32	1,144 75	605 01	530 53	1,135 54	-	5,000 00	258 41	5,258 41
Union,	372 75	-	128 68	1,335 91	1,837 34	1,083 00	620 50	1,216 20	1,837 34	1,617 10	4,600 00	400 00	3,382 90

Franklin, . . .	$600 00	$120 00	$645 00	$586 41	$1,951 41	$1,367 25	$848 25	$1,417 51	$2,265 82	-	$7,000 00	$50 00	$7,050 00
Deerfield Valley, .	527 90	-	969 96	973 09	2,470 95	1,062 50	609 97	623 00	4,056 33	$3,699 28	7,605 24	290 65	4,196 61
Berkshire, . .	600 00	700 00	221 00	3,153 30	4,674 30	3,198 50	2,974 50	1,650 68	4,415 58	-	15,000 00	1,000 00	16,000 00
Hoosac Valley, . .	600 00	106 00	1,049 00	4,470 38	6,225 38	1,604 25	1,200 50	2,659 63	6,519 27	5,200 00	11,000 00	767 68	5,800 00
Housatonic, . .	600 00	-	113 00	4,240 78	4,953 78	2,879 00	2,499 00	2,600 97	4,632 46	-	3,000 00	100 00	18,000 00
Norfolk, . . .	600 00	-	94 00	-	2,955 65	3,054 00	992 50	1,819 00	2,811 50	26,480 00	35,000 00	300 00	22,500 00
Hingham, . . .	600 00	-	458 87	6,722 55	7,781 40	1,695 35	932 35	6,359 63	7,625 95	4,000 00	34,600 00	4,597 15	31,600 00
Bristol, . . .	600 00	-	284 00	-	9,917 16	2,500 00	2,681 50	6,000 00	-	12,000 00	33,000 00	-	20,000 00
Bristol Central, .	600 00	-	12 00	2,160 34	2,772 34	2,433 00	-	1,170 13	-	6,166 00	20,000 00	500 00	14,434 00
Plymouth, . . .	600 00	200 00	412 25	7,887 70	9,099 95	2,993 25	2,323 22	4,777 09	8,808 77	-	28,000 00	1,000 00	28,000 00
Marshfield, . .	600 00	-	177 95	3,127 16	3,905 11	1,228 50	654 44	3,089 90	4,628 21	5,222 97	11,265 00	945 16	6,987 19
Barnstable, . .	600 00	-	43 00	1,261 73	1,904 73	827 00	607 42	1,227 21	1,834 63	1,650 00	6,000 00	200 00	4,550 00
Nantucket, . .	588 50	-	49 50	212 61	850 61	1,004 50	517 00	266 99	783 99	-	2,500 00	588 50	3,090 50
Martha's Vineyard, .	600 00	181 00	30 00	430 00	1,241 00	786 00	609 57	636 00	1,718 00	250 00	3,500 00	2,500 00	6,000 00
Totals, . .	$17,089 15	$8,630 04	$9,406 41	$83,366 12	$135,946 26	$51,339 10	$40,463 32	$69,482 69	$114,745 60	$195,433 22	$552,370 24	$103,108 75	$486,837 08

PERMANENT FUND—HOW INVESTED.

MASSACHUSETTS.—Bank stock, policies, Boston and U. S. bonds.
ESSEX.—In real estate, bank stock, U. S. and R. R. bonds, library, tent and cattle-pens.
MIDDLESEX.—In real estate, furniture and fixtures to building.
MIDDLESEX NORTH.—In land, buildings and personal property.
MIDDLESEX SOUTH.—In society's grounds, track, buildings, stalls, sheds and pens.
WORCESTER.—In real estate.
WORCESTER WEST.—In real estate and fixtures.
WORCESTER NORTH.—In real estate.
WORCESTER NORTH-WEST.—In grounds and buildings of the society, personal property, and cash in hand.
WORCESTER SOUTH.—In land, hall and track, furniture in hall, and fixtures.
WORCESTER SOUTH-EAST.—In real and personal estate.
HAMPSHIRE, FRANKLIN AND HAMPDEN.—In real estate and personal property.
HAMPSHIRE.—In real estate and hall.
HIGHLAND.—In savings bank, U. S. bonds, and mortgage.
HAMPDEN.—In land and buildings.
HAMPDEN EAST.—In real estate, cattle-pens, &c.
UNION.—In land, hall, track, furniture in hall, &c.
FRANKLIN.—In ten shares bank stock and deposit in Greenfield Savings Bank.
HOUSATONIC.—In real estate and notes of members.
BERKSHIRE.—In real estate.
HOOSAC VALLEY.—In real estate.
DEERFIELD VALLEY.—In real estate.
NORFOLK.—In real estate.
BRISTOL.—In real estate and personal property.
BRISTOL CENTRAL.—In real estate, farm and buildings, with appurtenances.
PLYMOUTH.—In real estate, fixtures and furniture, notes and cash.
MARSHFIELD.—In land and buildings and hall furniture.
HINGHAM.—In hall and grounds, furniture and fixtures, two dwelling-houses.
BARNSTABLE.—In land, buildings and fences.
NANTUCKET.—In fair grounds, office fixtures and cash.
MARTHA'S VINEYARD.—In real estate and notes of members.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

FARMS.

SOCIETIES.	For management of farms.	For experiments in draining.	For subsoiling.	For ploughing at exhibition.	For reclaiming swamp lands.	For experiments with manures.	For spading.	For hedges and ornamental trees.	For reclaiming old pastures.	For orchards of all kinds.	For cranberries.	For other farm improvements.	Total amount offered for farm improvements.	Total am't awarded for farm improvements.	Total am't actually paid for farm improvements.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	$30 00	$15 00	-	$139 00	-	-	-	-	-	-	-	-	$53 00	$184 00	$172 00
Middlesex,	-	-	-	72 00	-	-	-	-	-	-	-	-	340 00	72 00	72 00
Middlesex North,	-	-	-	-	-	-	-	-	-	-	-	-	*	*	*
Middlesex South,	-	-	-	42 00	$10 00	-	-	-	-	-	-	-	163 00	52 00	52 00
Worcester,	-	-	-	60 00	-	-	-	-	-	-	-	-	-	-	67 50
Worcester West,	-	-	-	69 00	-	-	-	-	-	-	-	-	129 00	69 00	69 00
Worcester North,	75 00	-	-	44 00	-	-	-	-	-	$35 00	-	-	450 00	82 00	82 00
Worcester North-West,	-	-	-	7 00	-	-	-	-	-	-	-	-	13 00	7 00	7 00
Worcester South,	-	-	-	59 00	-	-	-	-	-	-	$2 25	-	185 00	61 25	61 25
Worcester South-East,	-	-	-	85 00	-	-	-	-	-	-	-	-	222 00	85 00	50 40
Hampshire, Franklin & Hamp'n,	-	-	-	-	-	-	-	-	-	-	4 75	-	23 00	4 75	-
Hampshire,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highland,	-	-	-	-	-	-	-	-	-	4 00	-	-	15 00	4 00	4 00
Hampden,	-	-	-	-	20 00	-	-	-	-	-	-	$10 00	206 00	30 00	30 00

Hampden East,	–	–	–	$26 00	–	–	–	–	–	–	–	–	$187 00	$26 00	$26 00
Union,	–	–	–	–	–	–	–	–	–	$11 00	–	$9 00	56 00	20 00	20 00
Franklin,	–	–	–	–	–	–	–	–	–	–	–	–	54 00	–	–
Deerfield Valley,	–	–	–	–	–	–	–	–	–	–	$0 75	–	50 00	–	–
Berkshire,	$72 00	–	–	33 00	$10 00	$18 00	–	–	–	54 00	3 00	–	217 00	187 00	187 00
Hoosac Valley,	–	$15 00	–	–	–	14 00	–	–	–	15 00	–	–	56 00	44 00	44 00
Housatonic,	30 00	–	–	38 00	–	–	–	–	–	24 00	–	–	141 00	92 00	92 00
Norfolk,	–	–	–	50 00	–	–	–	–	–	–	5 00	–	320 00	55 00	71 00
Hingham,	–	–	–	20 00	–	–	–	–	–	–	5 95	–	201 00	25 95	25 95
Bristol,	–	–	–	126 73	–	–	–	–	–	–	–	–	283 00	–	–
Bristol Central,	–	–	–	59 00	–	–	–	–	–	–	1 50	–	80 00	60 50	60 50
Plymouth,	–	–	–	61 00	–	–	–	–	–	–	–	–	82 00	61 00	61 00
Marshfield,	–	–	–	35 00	–	–	–	–	–	–	7 00	–	194 00	42 00	42 00
Barnstable,	–	–	–	11 00	–	–	–	–	–	–	2 25	–	119 00	13 25	13 25
Nantucket,	–	–	–	16 00	–	–	–	–	–	–	–	–	112 00	16 00	16 00
Martha's Vineyard,	–	–	–	10 50	–	–	–	–	–	–	–	–	44 50	10·50	10 50
Totals,	$207 00	$30 00	–	$1,063 23	$40 00	$32 00	–	–	–	$133 00	$32 45	$19 00	$4,475 50	$1,204 20	$136 35

* In connection with the New England Agricultural Society.

Analysis of Premiums and Gratuities Awarded—Continued.

FARM STOCK.

SOCIETIES.	For Bulls.	For Milch Cows.	For Heifers.	For Calves.	For Working Oxen.	For Steers.	For Fat Cattle.	For Horses.	For Sheep.	For Swine.	For Poultry.	All other Stock.	Total amount offered for Live Stock.	Total amount awarded for Live Stock.	Total amount paid out for Live Stock.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	$33 00	$50 00	$38 00	-	$120 00	$7 00	$10 00	$196 00	$10 00	$15 00	$71 00	$75 00	$830 00	$621 00	$485 00
Middlesex, ‡.	28 00	110 00	22 00	$11 00	17 00	-	6 00	180 00	-	44 00	94 00	*25 00	870 00	537 00	537 00
Middlesex North,	-	-	-	-	-	-	-	-	-	-	-	-†	-†	-†	-†
Middlesex South,	18 00	54 00	39 00	9 00	28 00	5 00	20 00	730 00	14 00	48 00	215 00	28 50	1,479 00	1,244 00	1,156 00
Worcester,	83 00	174 00	151 00	8 00	107 00	67 00	32 00	970 00	23 00	38 00	15 00	191 00	2,189 00	1,859 00	1,744 75
Worcester West,	46 00	84 00	21 00	16 00	60 00	51 00	47 00	724 00	19 00	26 00	20 00	71 00	1,402 00	1,185 00	1,181 00
Worcester North,	49 00	56 00	83 00	31 00	33 00	7 00	13 00	134 00	1 00	40 00	35 00	74 00	1,018 00	556 00	494 00
Worcester North-West,	41 00	33 00	33 00	11 00	12 00	30 00	37 00	863 00	23 00	21 00	6 00	*71 00	1,303 00	1,181 00	1,089 00
Worcester South,	36 00	28 00	39 00	21 00	54 00	44 00	8 00	407 00	21 00	8 00	4 50	77 00	863 50	747 50	747 50
Worcester South-East,	20 00	28 00	30 00	6 00	55 00	35 00	8 00	314 00	8 00	35 00	17 25	73 00	767 00	629 25	567 95
Hampshire, Franklin & Hampden,	80 20	28 00	55 50	19 00	129 00	15 00	81 00	218 00	46 00	15 00	6 00	240 40	715 50	933 10	829 60
Hampshire,	33 00	43 00	10 00	12 00	64 00	13 00	15 00	142 50	15 00	24 00	24 00	15 00	537 00	386 50	396 00
Highland,	21 00	24 00	24 25	4 25	34 00	25 50	15 00	143 00	34 00	3 00	3 00	43 00	433 75	374 00	374 00

Hampden, . . .	$78 00	$106 00	$50 00	$26 00	$17 00	$13 00	$16 00	$96 00	-	$15 00	$38 00	$49 00	$674 00	$504 00	$477 50
Hampden East, . .	37 00	18 00	23 00	4 00	48 00	26 00	15 00	137 00	$22 00	20 00	10 00	52 00	594 00	412 00	370 00
Union, ...	16 50	28 00	17 75	8 50	44 00	7 00	24 00	172 75	4 00	3 00	2 25	35 00	669 00	362 75	362 75
Franklin, . . .	36 00	123 00	12 00	17 00	30 00	48 00	18 00	138 00	81 00	24 00	10 25	78 00	829 00	604 25	601 25
Deerfield Valley, . .	71 00	12 00	18 00	29 00	52 00	44 00	8 00	144 00	43 00	16 00	11 00	68 00	826 50	516 00	481 00
Berkshire, . . .	92 00	139 00	65 00	-	36 00	27 00	26 00	734 00	110 00	40 00	50 00	*36 00	1,549 00	1,355 00	1,355 00
Hoosac Valley, . .	24 00	31 00	12 00	3 00	29 00	10 00	19 00	168 00	110 00	15 00	40 00	*9 00	717 00	470 00	451 00
Housatonic, . . .	63 00	63 00	41 00	10 00	59 00	21 00	30 00	199 00	77 00	29 00	48 50	92 00	947 00	732 50	732 50
Norfolk, . . .	50 00	121 00	39 00	11 00	21 00	-	8 00	570 00	-	69 00	173 00	-	1,450 00	1,062 00	619 00
Hingham, . . .	22 00	64 00	48 00	27 00	21 00	-	35 00	46 00	31 75	94 00	40 25	30 00	828 25	459 00	459 00
Bristol, ...	57 00	179 00	99 00	30 00	144 00	43 00	114 00	205 00	35 00	58 00	95 25	42 25	914 25	1,101 50	-
Bristol Central, . .	64 00	72 00	134 00	-	73 00	-	49 00	1,014 00	27 00	29 00	86 25	-	1,749 00	1,548 25	-
Plymouth, . . .	72 36	149 00	44 72	24 80	60 00	40 00	75 00	779 00	60 50	55 28	85 00	90 00	1,823 00	1,535 72	1,535 72
Marshfield, . . .	18 00	33 00	19 00	5 00	14 00	5 00	27 00	80 00	-	24 00	37 00	-	448 50	262 00	262 00
Barnstable, . . .	15 00	11 00	21 00	8 00	12 00	7 00	28 00	103 00	18 00	15 00	31 00	-	336 00	269 00	269 00
Nantucket, . . .	22 00	88 50	8 50	7 00	12 00	15 00	27 00	73 00	24 00	9 00	27 25	-	529 25	313 25	313 25
Martha's Vineyard, .	18 00	20 00	48 25	8 50	12 00	29 50	36 00	55 00	37 00	5 00	12 75	26 00	360 75	308 00	308 00
Totals, . . .	$1,244 06	$1,989 50	$1,245 97	$367 05	$1,435 00	$635 00	$847 00	$9,725 25	$900 25	$847 28	$1,308 60	$1,601 15	$27,253 25	$22,070 57	$18,498 77

* Herds.

† In connection with the New England Agricultural Society.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED—Continued.

FARM PRODUCTS.

SOCIETIES.	Indian Corn.	Wheat.	Rye.	Barley.	Oats.	Beans.	Grass Crops.	Grass Seeds.	Potatoes.	Carrots.	Beets.	Parsnips.	English Turnips.	Ruta-Bagas.	Onions.	Other Root Crops.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	-	-	-	-	-	-	-	-	-	-	-	-	-	$10 00	-	$38 00
Middlesex,	$4 00	-	$3 00	-	$3 00	-	-	-	-	-	-	-	-	-	-	*99 50
Middlesex North,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-†
Middlesex South,	33 50	-	-	$6 00	1 00	$2 00	-	-	$7 50	-	$1 75	-	$1 50	‡11 00	$6 75	-
Worcester,	3 00	$3 00	3 00	1 00	3 00	1 00	-	-	6 00	$1 00	3 00	$1 00	-	1 00	1 00	-
Worcester West,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester North,	10 00	-	4 00	-	-	-	-	-	2 00	-	-	-	-	-	-	2 00
Worcester North-West,	3 00	4 00	-	-	3 00	1 00	-	-	3 00	-	1 00	-	1 00	-	1 00	12 00
Worcester South,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester South-East,	-	-	-	-	-	-	-	-	-	-	4 00	-	-	4 00	3 00	23 50
Hampshire, Franklin & Hamp'n,	-	-	-	-	-	-	-	-	1 00	-	-	-	-	-	-	2 00
Hampshire,	4 00	3 00	-	2 00	3 00	-	-	-	4 00	1 00	3 00	1 00	1 00	-	2 00	-
Highland,	12 50	-	-	5 00	11 00	3 00	$10 00	-	16 00	6 00	6 00	-	2 00	3 00	2 00	20 00
Hampden,	1 50	-	-	-	-	-	-	-	2 25	-	20 00	-	-	-	-	2 00

Hampden East,	$1 00	-	$7 25	-	-	-	-	-	$1 25	-	-	$0 50	$0 50	-	$1 00	-
Union,	16 00	-	-	$10 00	$4 00	-	$10 00	-	10 00	$4 00	-	-	7 00	-	7 00	$9 00
Franklin,	-	-	-	-	-	-	-	-	-	-	$0 50	-	-	-	-	-
Deerfield Valley,	11 75	-	-	-	-	$0 75	-	-	13 75	50	25	50	50	-	75	-
Berkshire,	65 00	$31 00	65 00	44 00	84 00	9 00	12 00	$7 00	69 00	12 00	12 00	-	12 00	$12 00	§62 00	11 00
Hoosac Valley,	28 00	15 00	15 00	12 00	21 00	5 00	14 00	42 00	28 00	-	5 00	-	-	6 00	3 00	
Housatonic,	127 00	40 00	76 00	17 00	76 00	6 00	36 00	4 00	29 00	14 00	13 00	-	7 00	-	1 00	24 00
Norfolk,	1 00	1 00	-	1 00	1 00	2 00	25 00	-	9 00	-	-	-	2 00	2 00	-	36 00
Hingham,	8 00	-	6 00	-	-	-	-	-	-	-	-	-	-	-	-	10 00
Bristol,	33 00	-	-	-	-	-	12 00	-	15 00	-	5 00	-	5 00	-	-	6 00
Bristol Central,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plymouth,	35 00	-	-	-	20 00	-	-	-	8 00	-	4 00	-	8 00	8 00	8 00	-
Marshfield,	13 00	-	1 00	-	-	7 50	-	-	15 00	3 00	-	-	3 00	-	4 50	36 00
Barnstable,	-	-	-	-	-	-	-	-	10 50	-	-	-	-	-	-	23 50
Nantucket,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Martha's Vineyard,	4 10	-	5 80	25	8 95	6 40	21 00	-	3 95	-	1 60	-	45	-	1 70	10 80
Totals,	$414 35	$237 00	$186 05	$98 25	$238 95	$43 65	$140 00	$53 00	$254 20	$41 50	$80 10	$3 00	$50 95	$57 00	$104 70	$347 30

* Vegetables. † In connection with the New England Agricultural Society. ‡ Squashes. § Grain Crops.

Analysis of Premiums and Gratuities Awarded—Continued.

FARM PRODUCTS—Concluded.

SOCIETIES.	Total amount offered for Grain and Root Crops.	Total am't awarded for Grain and Root Crops.	Total am't paid for Grain and Root Crops.	For Fruits.	For Flowers.	Any other cultivated Crops.	Butter.	Cheese.	Honey.	Wheat Bread.	Rye and Indian Bread.	Corn Bread.	Total am't paid out under the head of Farm Products.
Massachusetts, ...	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex, ...	$170 00	$48 00	$48 00	$191 00	$23 00	*$71 00	$28 00	-	-	-	$22 50	-	$624 00
Middlesex, ...	175 00	109 50	109 50	297 00	109 00	*34 00	20 00	-	-	$22 00	6 00	-	597 50
Middlesex North, ...	-	-	-†	-	-	-	-	-	-	-	-	-	-†
Middlesex South, ...	139 00	114 25	109 25	62 00	52 00	7 25	3 00	-	‡$22 75	9 00	4 00	-	232 75
Worcester, ...	29 00	55 00	52 00	25 00	14 00	-	25 00	$51 00	-	1 00	50	-	166 50
Worcester West, ...	79 00	-	-	59 00	18 75	17 00	10 00	31 00	-	6 00	6 00	-	142 75
Worcester North, ...	128 00	18 00	18 00	80 25	30 00	27 00	9 00	-	-	3 50	3 50	-	275 00
Worcester North-West, . .	45 00	29 00	26 00	34 00	12 00	-	9 00	8 00	3 00	3 00	-	-	93 00
Worcester South, ...	50 00	-	-	34 50	9 40	10 25	9 00	14 00	-	16 00	6 00	-	99 15
Worcester South-East, . .	140 00	34 50	20 70	79 25	19 20	-	17 50	-	8 50	7 00	-	-	99 37
Hampshire, Franklin & Hamp'n,	100 00	3 00	1 00	36 25	10 00	-	10 00	-	1 00	2 50	1 50	-	43 25
Hampshire, ...	66 00	39 00	39 00	59 00	29 50	-	4 00	10 00	-	3 00	3 00	-	142 00
Highland, ...	99 50	97 50	97 50	19 25	12 75	9 75	6 50	6 00	§4 00	1 50	50	$0 50	158 25

Hampden,	$388 00	$42 50	$27 00	$45 25	$9 00	-	$14 00	-	$3 00	$3 00	$3 00	-	$86 75
Hampden East,	109 75	25 50	25 50	32 00	15 30	$4 50	11 00	$11 00	-	3 00	6 00	-	108 05
Union,	175 00	77 00	77 00	24 50	7 40	10 00	4 50	8 00	1 50	2 50	1 75	$2 00	159 15
Franklin,	132 00	3 50	-	88 50	21 00	1 00	29 00	15 00	3 00	5 25	3 50	8 50	136 75
Deerfield Valley,	25 00	28 50	23 75	26 25	5 00	4 25	10 00	6 00	-	4 00	4 50	-	72 30
Berkshire,	531 00	511 00	511 00	83 00	30 00	66 00	41 00	54 00	10 00	30 00	10 00	10 00	845 00
Hoosac Valley,	227 00	194 00	193 25	84 50	23 00	64 25	31 00	52 00	§19 00	14 00	5 50	-	482 50
Housatonic,	554 00	470 00	470 00	149 00	47 00	45 00	36 00	35 00	§17 00	9 00	6 00	6 00	820 00
Norfolk,	181 00	80 00	76 00	185 00	61 00	-	35 00	8 00	-	5 00	5 00	-	260 00
Hingham,	176 00	24 00	24 00	92 90	30 00	47 10	14 50	7 00	-	14 25	1 00	-	230 75
Bristol,	289 00	76 00	-	105 50	24 00	-	42 00	25 00	18 00	16 50	6 00	-	-
Bristol Central,	208 00	26 95	-	74 50	32 00	-	22 00	5 00	11 00	3 25	1 75	-	-
Plymouth,	245 00	91 00	91 00	108 00	41 50	*47 00	39 00	39 00	‡25 00	23 00	15 00	-	337 50
Marshfield,	119 00	83 00	83 00	58 00	29 10	-	15 00	15 00	‡20 87	4 50	3 00	-	228 47
Barnstable,	107 00	34 00	34 00	42 75	35 70	-	9 00	9 00	‡2 50	6 00	6 00	-	144 95
Nantucket,	135 00	-	-	55 50	16 50	33 75	10 00	-	3 00	3 50	-	-	121 25
Martha's Vineyard,	129 00	65 00	65 00	52 15	7 05	19 00	12 87	-	-	16 75	2 00	3 00	171 82
Totals,	$4,851 25	$2,379 70	$2,231 45	$2,283 80	$772 15	$518 10	$526 87	$429 00	$173 12	$240 00	$133 50	$30 00	$6,880 71

* Vegetables. † In connection with the New England Agricultural Society. ‡ Jellies, preserves, &c. § Honey and maple sugar.

Analysis of Premiums and Gratuities Awarded—Concluded.

MISCELLANEOUS.

SOCIETIES.	For Agricultural Implements.	Offered for raising forest trees.	Awarded for the same.	For experiments on manures.	Amount awarded for objects strictly agricultural not specified before.	For objects not strictly agricultural; domestic manufactures, &c.	No. of persons who received premiums and gratuities.
Massachusetts,	*$100 00	†$144 00	-	‡$300 00	-	§$550 00	-
Essex,	68 00	30 00	-	25 00	-	187 50	289
Middlesex,	100 00	-	-	-	-	142 50	-
Middlesex North,	-	-	-	-	-	-	-
Middlesex South,	16 00	60 00	-	-	-	60 75	145
Worcester,	35 00	22 00	-	-	-	15 50	117
Worcester West,	2 00	30 00	-	10 00	$6 00	93 70	174
Worcester North,	21 00	50 00	-	90 00	30 00	339 25	201
Worcester North-West,	11 00	30 00	-	-	5 00	90 00	96
Worcester South,	-	35 00	-	-	-	35 50	135
Worcester South-East,	18 00	30 00	-	-	-	138 00	213
Hampshire, Franklin & Hampden,	45 00	20 00	-	-	6 00	72 25	110
Hampshire,	14 25	8 00	-	15 00	21 25	70 30	164
Highland,	-	-	-	-	-	90 50	153
Hampden,	39 00	15 00	$35 87	-	-	95 75	76
Hampden East,	7 00	25 00	-	86 00	-	100 96	99
Union,	1 50	-	-	-	45 85	30 75	141
Franklin,	1 00	10 00	-	5 00	-	103 25	196
Deerfield Valley,	12 50	-	-	-	6 00	94 00	222
Berkshire,	24 00	-	-	-	54 00	509 50	647
Hoosac Valley,	11 00	-	-	14 00	-	212 00	302
Housatonic,	27 00	-	-	-	-	299 75	376
Norfolk,	6 00	15 00	-	-	-	52 75	179
Hingham,	15 00	-	-	-	247 60	-	-
Bristol,	50 00	30 00	30 00	60 00	-	302 50	562
Bristol Central,	17 00	-	-	-	-	171 25	180
Plymouth,	23 00	60 00	60 00	-	23 00	192 00	444
Marshfield,	15 00	50 00	-	20 00	-	170 47	352
Barnstable,	1 50	7 00	-	12 00	12 75	165 97	240
Nantucket,	-	13 00	-	16 00	-	81 75	119
Martha's Vineyard,	-	11 00	-	16 00	-	119 25	141
Totals,	$680 75	$695 00	$125 87	$669 00	$430 45	$4,577 65	6,073

* To aid in perfecting a steam plough.
† Four scholarships in Massachusetts Agricultural College.
‡ Department of Agricultural Chemistry, Bussey Institute, for experiments in manures.
§ Services of experts in awarding fish premiums.

NAMES of Cities and Towns to which the Premiums and Gratuities were disbursed, and the amount to each.

ESSEX.

Amesbury,	$25 00	Manchester,	$2 00
Andover,	23 00	Marblehead,	70 00
Beverly,	17 00	Methuen,	24 00
Boston,	33 00	Newbury,	85 00
Boxford,	25 00	Newburyport,	16 00
Bradford,	15 00	North Andover,	44 00
Danvers,	70 00	Peabody,	39 00
Essex,	63 00	Rockport,	53 00
Gloucester,	428 00	Rowley,	4 00
Groveland,	13 00	Salem,	43 00
Hamilton,	121 00	Topsfield,	15 00
Hampton Falls, N H.,	5 00	West Newbury,	76 00
Haverhill,	11 00		
Ipswich,	37 00	Total,	$1,369 00
Lynn,	12 00		

MIDDLESEX.

Acton,	$96 00	Hudson,	$8 00
Arlington,	29 00	Lexington,	74 00
Bedford,	27 00	Lincoln,	175 50
Belmont,	21 00	Littleton,	11 00
Billerica,	12 00	Marlborough,	9 00
Boston,	53 00	Maynard,	3 00
Burlington,	9 00	Medford,	11 00
Boxborough,	14 00	North Reading,	6 00
Cambridge,	116 00	Pepperell,	3 00
Carlisle,	12 00	Somerville,	8 00
Charlestown,	1 00	Stoneham,	33 00
Concord,	329 00	Stow,	2 00
Fitchburg,	15 00	Sudbury,	24 00
Framingham,	32 00	Waltham,	64 00

MIDDLESEX.—Concluded.

Watertown,	$10 00	Woburn,	$110 00
Wayland,	39 50	Providence, R. I.,	15 00
Weston,	51 00		
Winchester,	26 00	Total,	$1,449 00

MIDDLESEX SOUTH.

Ashland,	$28 00	Southborough,	$18 00
Framingham,	1,026 25	Sudbury,	47 50
Holliston,	5 00	Wayland,	123 45
Marlborough,	20 00	Out of the district,	178 00
Natick,	65 50		
Newton,	30 00	Total,	$1,543 50
Sherborn,	2 00		

WORCESTER.

Auburn,	$2 00	Rutland,	$13 50
Barre,	9 50	Shrewsbury,	32 97
Bolton,	18 25	Spencer,	31 00
Boylston,	2 25	Southbridge,	8 00
Charlton,	39 70	Sterling,	1 75
Grafton,	21 22	Sutton,	199 28
Holden,	14 00	Webster,	55 00
Lancaster,	1 50	Westborough,	99 66
Mendon,	19 60	Warren,	25 50
Millbury,	127 00	West Boylston,	45 50
New Braintree,	22 00	Worcester,	1,267 75
Oxford,	31 22		
Princeton,	57 12	Total,	$2,145 27

WORCESTER WEST.

Athol,	$3 75	Fitchburg,	$133 00
Barre,	428 90	Hardwick,	45 75
Bernardston,	18 00	Hubbardston,	7 00
Brookfield,	10 00	New Braintree,	128 50
Charlton,	56 00	North Brookfield,	51 50

WORCESTER WEST.—Concluded.

Oakham,	$10 05	Warren,	$7 00
Orange,	20 00	Westborough,	5 00
Palmer,	85 00	West Brookfield,	30 00
Petersham,	3 50	Worcester,	366 50
Phillipston,	58 00		
Princeton,	5 00	Total,	$1,474 95
Templeton,	3 50		

WORCESTER NORTH.

Ashburnham,	$1 75	Sterling,	$2 25
Ayer,	50	Templeton,	10 00
Fitchburg,	570 11	Winchendon,	1 00
Harvard,	10 00	Fitzwilliam, N. H.,	1 00
Leominster,	211 42		
Lunenburg,	86 07	Total,	$916 10
Princeton,	22 00		

WORCESTER NORTH-WEST.

Athol,	$223 34	Phillipston,	$163 75
Barre,	25 00	Shelburne Falls,	60 00
Bernardston,	4 00	South Framingham,	283 00
Cambridge,	25 00	Royalston,	43 25
Hardwick,	8 00	Templeton,	25 00
Medford,	200 00	Westborough,	75
Montague,	48 33	Weston,	1 33
New Braintree,	25 00	Winchendon,	5 00
New Salem,	9 50	Winchester, N. H.,	4 00
Orange,	14 50	Worcester,	6 00
Palmer,	75 00		
Petersham,	25 25	Total,	$1,275 00

WORCESTER SOUTH.

Brimfield,	$11 00	Holland,	$32 00
Brookfield,	85 00	Oxford,	36 00
Charlton,	128 25	Palmer,	25 00
Dudley,	64 00	Spencer,	20 00

WORCESTER SOUTH.—Concluded.

Southbridge,	$94 25	Webster,	$58 00
Sutton,	58 00	Worcester,	223 00
Sturbridge,	107 40		
Wales,	5 00	Total,	$987 90
Warren,	41 00		

WORCESTER SOUTH-EAST.

Bellingham,	$3 50	Milford,	$388 85
Blackstone,	3 00	Northbridge,	1 00
Charlton,	4 00	Sturbridge,	15 00
Framingham,	26 27	Sutton,	80 00
Franklin,	5 00	Upton,	61 50
Grafton,	4 00	Uxbridge,	14 50
Holliston,	9 50	Westborough,	5 50
Hopkinton,	60 00	Worcester,	26 00
Medway,	5 00		
Mendon,	122 75	Total,	$835 37

HAMPSHIRE, FRANKLIN AND HAMPDEN.

Amherst,	$5 00	Holyoke,	$3 00
Bernardston,	1 00	Northampton,	247 15
Chicopee,	31 50	Shelburne,	172 00
Cummington,	18 50	Springfield,	23 50
Deerfield,	119 50	Southampton,	38 20
Easthampton,	20 75	South Hadley,	46 00
Gill,	30 00	Sunderland,	13 00
Granby,	4 00	Whately,	5 50
Greenfield,	2 00	Williamsburg,	4 00
Hadley,	101 00		
Hatfield,	36 00	Total,	$921 60

HAMPSHIRE.

Amherst,	$176 50	Enfield,	$7 00
Belchertown,	25 50	Granby,	4 00
Brighton,	3 00	Hadley,	121 50
Easthampton,	2 00	Hatfield	7 00

HAMPSHIRE—Concluded.

Leverett,	$34 25	Stafford Springs, Ct.,	$2 00
Montague,	4 00	South Hadley,	57 50
Northampton,	10 00	Sunderland,	21 80
Pelham,	29 75		
Prescott,	10 0	Total,	$618 30
Shutesbury,	3 00		

HIGHLAND.

Becket,	$38 00	Middlefield,	$313 75
Blandford,	30 00	Northampton,	2 50
Boston,	2 00	Peru,	46 25
Canaan,	8 75	Pittsfield,	1 50
Chester,	52 25	Plainfield,	50
Dalton,	8 00	Sandisfield,	8 00
Feeding Hills,	75	Springfield,	3 50
Hinsdale,	69 75	Washington,	9 25
Huntington,	5 00	Westfield,	1 00
Ithica, N. Y.,	3 50	Worthington,	6 00
Lanesborough,	15 50		
Lee,	1 00	Total,	$626 75

HAMPDEN.

Agawam,	$0 75	Springfield,	$162 25
Blandford,	2 50	Suffield,	5 00
Chicopee,	75 00	Westfield,	292 87
Granville,	3 00	West Springfield,	36 50
Montgomery,	9 00	Wilbraham,	41 00
Russell,	75		
Southwick,	28 50	Total,	$657 12

HAMPDEN EAST.

Belchertown,	$15 75	Charlton,	$46 00
Brimfield,	14 50	Holland,	5 50
Brooklyn, Ct.,	4 00	Monson,	267 68
Boston,	1 00	Longmeadow,	8 00

HAMPDEN EAST—Concluded.

Palmer,	$195 33	West Brookfield,	$15 00
Springfield,	8 00	Wilbraham,	4 25
Sturbridge,	11 50		
Warren,	9 00	Total,	$605 01

UNION.

Becket,	$16 50	Otis,	$7 00
Blandford,	449 00	Russell,	14 00
Chester,	31 25	Sandisfield,	1 50
Granville,	21 75	Springfield,	4 00
Huntington,	6 50	Holland,	2 50
Middlefield,	9 00	Westfield,	37 50
Miscellaneous,	15 50		
Montgomery,	4 50	Total,	$620 50

FRANKLIN.

Amherst,	$3 00	Leverett,	$18 50
Athol,	1 50	Leyden,	28 00
Bernardston,	15 25	Montague,	7 50
Chicopee,	1 00	Northfield,	4 50
Coleraine,	39 75	Orange,	1 50
Conway,	33 50	helburne,	343 75
Deerfield,	108 00	Sunderland,	18 50
Erving,	1 00	South Hadley,	5 00
Gill,	22 75		
Greenfield,	185 25	Total,	$848 25
Hardwick,	10 00		

DEERFIELD VALLEY.

Ashfield,	$19 20	Charlemont,	$165 80
Bernardston,	5 00	Cheshire,	2 00
Boston,	25	Coleraine,	51 00
Buckland,	63 00	Deerfield,	20 00

DEERFIELD VALLEY—Concluded.

Florida,	$6 00	Rowe,	$48 00
Greenfield,	30 50	Savoy,	14 50
Hawley,	69 75	Whately,	4 00
Heath,	39 50	Whitingham, Vt.,	2 00
Monroe,	36 25	Shelburne,	112 75
Montague,	2 00		
Plainfield,	25 00	Total,	$716 50

BERKSHIRE.

Adams,	$163 00	New Ashford,	$41 50
Alford,	15 00	Pittsfield,	828 25
Becket,	13 00	Providence, R. I.,	1 00
Cheshire,	130 00	Richmond,	84 25
Dalton,	60 00	Savoy,	4 50
Egremont,	13 00	Sheffield,	54 50
Great Barrington,	419 00	Stockbridge,	242 00
Hinsdale,	68 00	Washington,	3 00
Hancock,	29 00	Williamstown,	104 50
Lanesborough,	232 50	Windsor,	3 00
Lee,	239 00		
Lenox,	226 50	Total,	$2,974 50

HOOSAC VALLEY.

Blackington,	$31 00	Peru,	$4 50
Cheshire,	103 25	Pittsfield,	5 75
Clarksburg,	17 25	Pownal, Vt.,	42 00
Florida,	23 00	Savoy,	11 00
Hancock,	4 75	South Adams,	169 75
Lanesborough,	4 50	Stamford, Vt.,	6 00
Lee,	3 00	Stockbridge,	3 00
Lenox,	9 00	Williamstown,	333 00
Miscellaneous,	2 00		
New Ashford,	26 50	Total,	$1,200 50
North Adams,	401 75		

HOUSATONIC.

Adams,	$7 00	Otis,	$14 00
Alford,	106 00	Pittsfield,	9 00
Egremont,	298 00	Richmond,	31 00
Great Barrington,	538 00	Sheffield,	418 00
Lee,	202 00	Sandisfield,	31 00
Lenox,	40 00	Stockbridge,	27 00
Monterey,	41 00	West Stockbridge,	51 00
Mount Washington,	10 00	Tyringham,	3 00
Miscellaneous,	7 00		
New Marlborough,	33 00	Total,	$1,935 00

NORFOLK.

Boston,	$6 25	North Abington,	$0 25
Brookline,	107 00	Norwood,	35 00
Canton,	49 75	Quincy,	27 00
Dedham,	66 00	Randolph,	9 50
Dorchester,	85 50	Roxbury,	16 50
Dover,	18 00	Sharon,	6 25
Foxborough,	64 00	Stoughton,	86 00
Franklin,	10 00	Walpole,	18 00
Hyde Park,	70 25	West Roxbury,	65 00
Medfield,	15 00	Wrentham,	46 00
Medway,	50		
Milton,	296 00	Total,	$1,159 75
Needham,	62 00		

HINGHAM.

Boston,	$28 00	Quincy,	$9 25
Cohasset,	2 90	Scituate,	17 00
Hanover,	3 00	South Scituate,	34 05
Hingham,	662 65	Weymouth,	54 10
Hull,	14 00		
Lynn,	95	Total,	$932 35
Marshfield,	3 00		

BRISTOL CENTRAL.

Achusnet,	$48 50	Mansfield,	$165 00
Berkley,	111 50	New Bedford,	776 25
Boston,	12 00	Newport,	5 00
Bridgewater,	95 00	North Abington,	1 50
Dartmouth,	49 25	Providence, R. I.,	5 00
Dighton,	9 50	Rochester,	17 50
Framingham,	3 00	Raynham,	67 00
Fairhaven,	11 75	Somerset,	19 00
Freetown,	43 50	Taunton,	190 45
Fall River,	161 50		
Lakeville,	168 25	Total,	$1,960 45

PLYMOUTH.

Abington,	$57 25	Middleborough,	$252 08
Bridgewater,	627 00	North Bridgewater,	351 75
Carver,	3 50	Pembroke,	6 00
Duxbury,	6 25	Plymouth,	10 50
East Bridgewater,	145 25	Plympton,	17 75
Halifax,	126 25	Rochester,	24 00
Hanson,	5 00	Wareham,	30 00
Hingham,	1 00	West Bridgewater,	144 78
Kingston,	20 00	Out of the County,	309 50
Lakeville,	162 36		
Marion,	16 00	Total,	$2,323 22
Marshfield,	2 00		

MARSHFIELD.

Abington,	$11 22	Hanover,	$7 50
Ashland,	25	Hartford, Ct.,	50
Boston,	15 00	Hingham,	50
Bridgewater,	54 00	Hyde Park,	1 00
Cambridge,	1 00	Kingston,	12 45
Duxbury,	109 02	Marshfield,	262 35
Easton,	50	Newton,	25
Hanson,	11 37	Pembroke,	42 25

MARSHFIELD—Concluded.

Plymouth,	$8 00	South Scituate,	$19 25
Plympton,	3 00	Weymouth,	17 00
Quincy,	1 50		
Revere,	3 00	Total,	$654 44
Scituate,	73 50		

BARNSTABLE

Barnstable,	$342 67	West Barnstable,	$120 50
Hyannis,	51 25	Yarmouth,	60 75
Sandwich,	32 25	Total,	$607 42

NANTUCKET.

Nantucket,	$517 00

MARTHA'S VINEYARD.

Chilmark,	$238 00	Tisbury,	$287 00
Edgartown,	84 57	Total,	$609 57

ABSTRACT OF RETURNS

OF THE

AGRICULTURAL SOCIETIES

OF

MASSACHUSETTS,

1872.

EDITED BY

CHARLES L. FLINT,

SECRETARY OF THE STATE BOARD OF AGRICULTURE.

BOSTON:

WRIGHT & POTTER, STATE PRINTERS,

19 PROVINCE STREET.

1873.

PREFACE.

The returns of the Agricultural Societies, though in many cases less full and complete than they have sometimes been, present an unusual variety of suggestive papers in the form of addresses and essays, while the statements of exhibitors and competitors for premiums are, in some cases, of a high order of merit. The value of this part of the volume depends very much upon the character of the material furnished by the societies in their returns to this office. If they are meagre and below the requisite standard of excellence, it becomes very difficult, by any art of the compiler, to make them, what they should be, interesting, practical and instructive.

It has been my endeavor, during the last twenty years, to impress upon the officers of the various societies, the importance of greater care and attention, to secure full and valuable reports from the committees having the different parts of the exhibitions in charge. That these efforts have not been wholly in vain is sufficiently manifest in the excellence of the material in the following pages. Startling novelties are not expected, but sound common sense, clearness, and definiteness of statement, and honesty in reporting the results of experiments, are indispensable. The want of minuteness of statement has been the chief reason for excluding some papers which, but for this, would have appeared in this volume. The use of a "load" of manure, for example, in the cultivation of certain crops, is altogether too indefinite, and it conveys no accurate idea to a person in a distant locality.

I am indebted, for the lifelike drawing and engraving of "Fearnaught," which forms the frontispiece to the Report, to his owner, Col. HENRY S. RUSSELL, of Home Farm, Milton. This celebrated horse is claimed as a son of "Young Morrill," although his high breeding, as well as the faculty of imparting to his colts his own speed and

action, has led some to think that his sire was a thoroughbred son of "Wild Irishman." His dam was sired by the "Steve French Horse"; he by "Flint Morgan"; he by "Sherman Morgan." The dam of the "Steve French Horse" was by "Harpinas"; he by "Hambletonian"; he by imported "Messenger."

"Fearnaught" has a public record of 2.23¼, obtained at Buffalo in 1868, when he won the $10,000 prize, beating the famous trotters "American Girl," "George Palmer," "Hotspur," and "Myron Perry"; and in private has trotted a mile in 2.21½ to WAGON.

He won the first premium at the New England Fairs of 1871 and 1872, as well as the Gold Medal which was given to the horse exhibiting the best specimen of stock; and the many successful races in which his get have engaged have already placed him among the first on the list of the most valuable horses of this country.

CHARLES L. FLINT.

BOSTON, January, 1873.

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AGRICULTURAL EXHIBITIONS—1873.

Essex, at *Gloucester*,	September 23 and 24.
Middlesex, at *Concord*,	September 23 and 24.
Middlesex North, at *Lowell*,	September 25 and 26.
Middlesex South, at *Framingham*,	September 16 and 17.
Worcester, at *Worcester*,	September 18 and 19.
Worcester West, at *Barre*,	September 25 and 26.
Worcester North, at *Fitchburg*,	September 23 and 24.
Worcester North-West, at *Athol*,	October 7 and 8.
Worcester South, at *Sturbridge*,	September 11 and 12.
Worcester South-East, at *Milford*,	September 30 and October 1.
Hampshire, Franklin and Hampden, at *Northampton*,	October 2 and 3.
Hampshire, at *Amherst*,	September 30 and October 1.
Highland, at *Middlefield*,	September 11 and 12.
Hampden, at *Springfield*,	October 7 and 8.
Hampden East, at *Palmer*,	October 14 and 15.
Union, at *Blandford*,	September 18 and 19.
Franklin, at *Greenfield*,	September 25 and 26.
Deerfield Valley, at *Charlemont*,	September 30 and October 1.
Berkshire, at *Pittsfield*,	October 7, 8 and 9.
Housatonic, at *Great Barrington*,	September 24, 25 and 26.
Hoosac Valley, at *North Adams*,	September 23, 24 and 25.
Norfolk, at *Readville*,	September 25 and 26.
Bristol, at *Taunton*,	September 30, and October 1 and 2.
Bristol Central, at *Myrick's*.	September 10, 11 and 12.
Plymouth, at *Bridgewater*,	September 17, 18 and 19.
Hingham, at *Hingham*,	September 23 and 24.
Marshfield, at *Marshfield*,	October 1, 2 and 3.
Barnstable, at *Barnstable*,	October 7 and 8.
Nantucket, at *Nantucket*,	September 24 and 25.
Martha's Vineyard, at *West Tisbury*,	October 7 and 8.

AGRICULTURE OF MASSACHUSETTS.

WHAT SHALL WE RAISE?

From an Address before the Essex Agricultural Society.

BY WILLIAM D. NORTHEND.

What shall our farmers raise, and what mode of cultivation shall they adopt from which they can expect the greatest profit?

In considering these questions, we should have regard not only to the crops we should grow in the place of cereals, but to the necessary changes involved in the introduction of so large a non-agricultural population in our communities. Upon examination, it will be found that the location of farms is of primary consequence—whether near to or remote from large towns. Indeed, as lands are now cultivated, the whole system of cultivation of farms in proximity to towns is so different from the system of cultivation of those remote, that they may properly be treated separately.

Farms near to towns have a special value for the raising of a large variety of vegetables and for the production of milk, for which the populations of the towns furnish a ready market. Experience has shown that for the greatest profit this cultivation must be very thorough, and that it should be made a specialty, and that small farms under a high state of cultivation are the most remunerative. But this mode of culture requires very large amounts of manure, which cannot be furnished from the farm, as it is cultivated for crops which are not returned to the soil. This is supplied from the towns—from the stables and the refuse of the streets and dwellings, which can be transported to the farm at little expense, and

which without this demand would be of no value. The requirements of farms for the production of milk are different. The farms, to be profitable, must be larger, and, as much of the manure needed for the crops is derived from the stock, there is, of course, less to be transported from the towns.

But farmers remote from large towns have neither these advantages of a market nor of manure, as the cost and time required for transportation are too great in competition with farmers in the vicinity of the towns. The greatest profit on these farms is from the production of hay. This is their specialty. And these farms, for economy of management and for profit, should be large. It is impossible for the farmer to make a living from the production of hay on the number of acres which would be sufficient for the farmer near to the town.

But hay cannot be produced without manure. The farmer must return to the soil equivalents for what he takes from it in his annual crops, if he would keep up its condition. Every farmer knows that a large portion of the manure applied under the old system was required for the raising of the cereals, and that grass is not so exhausting to the soil as corn. Consequently, if the growing of cereals shall be discontinued, and all the manure of the farm applied in the best manner for the growing of grass, the amount grown will be much larger. But this is not all. There is scarcely a farm in New England upon which there are not beds of muck or other deposit, from which material may be taken, which, incorporated with the manure of the barn-yard, will furnish a large supply of fertilizing matter for the farm. When the farmer learns that he is to look for profits to the surplus of hay he produces, he will soon discover means of increasing the fertility of his fields without resorting to the uncertain fertilizers of commerce. But the fields from which the hay is produced are not the only lands which require the attention of the farmer. The condition of his pastures, in which he feeds his stock a considerable portion of the year, is of great consequence. The pastures of New England, especially those of this part of it, have sadly deteriorated. Most of them will not support one-half the stock they did half a cen-

tury ago. How far they can be economically improved, it is impossible to predict. But all can be improved. Where the pastures consist of good and clear land, they may be cultivated and manured for a few years, and the stock in the meantime turned into the poorer fields, and thus the pastures be fully renovated. Where this is not practicable, they may be much improved for years by a single ploughing and seeding down, even without the application of manures. Any stirring up of their soils will prove beneficial.

These are a few of the suggestions which occur in reference to the change required in the agriculture of our section. The crops which have been referred to, have been selected not as the only crops to be grown, but as the principal staples for the market. Our farmers, in the necessary rotation of crops, will find it for their advantage to raise more or less of the products which are unprofitable in the market. They will grow some crops for their own consumption, which they can purchase cheaper. But these crops will be subsidiary to the main productions. They will also find with the further growth of our own and the other sections, that additional changes in the varieties of crops to be cultivated will be required. We are advancing fast and far. The various and rapidly increasing industrial pursuits in which the people of the country are engaged, act and re-act upon each other, and all are undergoing constant modifications with the wonderful developments of every year.

Thus the farmer of New England is reaping his share of the blessings which the system of reciprocity organized by our fathers has conferred upon the people of the country. But this the farmer does not always appreciate. Instead of comparing his condition with that of the farmer of half a century ago, he is apt to contrast the profits of his fields with the profits which, at the present time, capital employed in other industries yields. He sees fortunes made in trade and manufactures which he can never hope to realize from his farm, and it tends to discontent. He even concludes that farming in New England is a doomed occupation. But if he will survey the whole field, and consider all the circumstances and contingencies of the different occupations, he will find much for his encouragement. It is an accepted business

axiom that profits are in proportion to the risks. The risks which the men who make large fortunes incur, are seen in the wrecks which are strewed around us. Indeed, the risks of the money-making avocations, as they are called, are such, that if prosecuted for a long period, financial ruin is the rule and not the exception.

The farmer does not make large profits. His capital is subject to no risks, except from his own extravagance or mismanagement. With prudence and good husbandry, though his crops may occasionally fail, he can always obtain a good living without sale or mortgage of his lands. His capital is always safe, and his accumulations, though small, are certain. He may not die a rich man, and he will not live a bankrupt.

But let him compare his condition with that of the farmer of half a century ago. It is plain that if he would be content to live as the farmer then did, upon the products of his farm, from his surplus productions, with the market of to-day, he could soon acquire wealth. But the farmer of to-day does not so live, and he has abundant reason to thank God that he is not compelled to. The farmer of to-day lives better than did the farmer of half a century ago. He receives not only the necessaries of life, but enjoys many of its comforts and luxuries. He dresses better, his house is better and more comfortable, and furnished with taste, and even elegance. He has more time and opportunities for reading and study. He mingles more with the world. He invests more in charities. He is enabled to improve himself, and to properly care for and educate his children, the best and noblest products of his farm. He is enabled to accomplish all these things from the profits of his fields, and if at the end of the year he has laid by no more than did the farmer of half a century ago, he has made investments which no calamities in the future can destroy.

But I am reminded by the place of our meeting of "the fields that no man ploughs, and the farm that pays no fee."

These fields are yours, sturdy men of Cape Ann. The boundless deep with its myriad products is spread out before you. The plough, the spade, the hoe, are implements unknown in your farming. Beneath the sounding sea is the vast and fertile garden, which for all time and without culti-

vation, will furnish the nutriment for your productions. Your farming, though full of toil and danger, is a continual harvest. You are joint tenants of the farm,—each gathers where he pleases, without causing any diminution for those who follow.

Your products, like those of the farmer who ploughs his fields, find a free market not only in our own, but in every section of the country.

These views suggest another important and most interesting inquiry to our farmers. It is, whether the great manufacturing prosperity of New England, which is the support of our agriculture, is a permanent one. It is plain that our people have a great superiority for manufacturing, in the future, over the people of the other sections, from the fact that the various branches are here fully established and in successful operation. This fact, other circumstances being equally favorable to all, gives to our people an immense advantage. But this is not all, nor the principal advantage which our people possess over the people of the other sections for success in manufacturing industries.

Industrial pursuits, like natural productions, are largely influenced by natural causes. The peculiar adaptations of our people for manufacturing are traceable to climate and soil as principal primary causes.

Our climate is favorable to the fullest mental and physical development in the people, and operates as a stimulant upon their strength and vigor. It is not so cold as to chill their energies or to dwarf their physical organizations, nor so warm as to produce enervation or lassitude. The winters are long and cold, in which there can be no employment in the fields, and the people from necessity lead an indoor life. The soil is sterile and worn, and can give remunerative employment to only a limited population. The sobriety of temperament and habits of patience, perseverance and regularity to which these conditions tend, fit and dispose our people for the arduous and unremitting labor of the workshops.

These conditions give to our people great advantages over the people of the other sections for the successful prosecution of these industries, both in disposing them for the labor and in enabling them to accomplish more in it. Operatives at the

South, owing to the debilitating influences of the heat, are incapable of competing successfully with operatives at the East, and the inhabitants of rich and productive agricultural regions, like those of the South or West, cannot be induced to perform the continuous labor which is required in the shops. As man is constituted, if the climate where he lives is congenial for out-of-door pursuits, or if land is plenty and cheap and he can obtain an easy living from it, he will never voluntarily submit to the constant labor and fatigue of the shops as an occupation for life.

The correctness of these propositions is not to be tested by the results of single experiences covering brief periods of time, because so subtle and various are the operations of causes, that it is impossible to determine correctly, from a few instances alone, how far exceptional influences may have affected the results they seem to prove. To arrive at even an approximately correct conclusion from results of experience alone, we must select a long period of time, collect the details and results under the different circumstances of the period, and by a process of generalization bring them all to bear upon the decision to be made.

The fact that within the last few years the people of the South and of the West have turned their attention more than ever before to manufacturing industries, does not prove that the propositions I have above stated are erroneous. The circumstances of the country, since the close of the war, have been exceptional. The duties on imported goods have been higher than ever before, the demand for manufactured articles has been large and the profits great, so that, for the time, manufacturing may have been remunerative under circumstances far less favorable than those which affect the people of New England.

Under ordinary circumstances, prices of manufactured articles, from competition between manufacturers, will be such that the profits on the capital employed will be in proportion to the profits on capital employed in other pursuits. And as labor enters largely into the cost of manufactured articles, if one section of the country has advantages in labor not possessed by the others, these advantages, other circumstances being the same in all, will inevitably in time give to it a

monopoly in manufactures. A very slight difference in the cost of manufacturing will in the end compel those against whom the difference exists, from the market. If in one section or belt of the country sufficient to supply the whole, any staple production of agriculture can be raised cheaper than in the others, including the cost of transporting it to the market, even if the difference is small, inevitably, in time, that section or belt of the country will have the control of the market in that staple. So, if in one section or belt of the country, under the same conditions, manufacturing can be carried on cheaper than in the other parts, even if the difference is small, as surely that section or belt of the country will control the market in manufactured articles.

At a very early period in their history, the people of New England commenced the erection of mills and the manufacture of the coarser varieties of articles needed by the people of the several colonies. Although the amount they manufactured was small, it was sufficient to attract the attention of the manufacturers in the parent country, who claimed an exclusive monopoly in the colonial markets for their own goods. Upon representations made by them, Parliament passed a law as early as in 1699, forbidding the transportation of goods of American manufacture, with a view to prevent the people of New England from supplying the people of the other colonies with their manufactured goods. In 1731, commissioners of the Board of Trade considered and made a report to the House of Commons on the subject of American manufactures, in the conclusion of which they say: "From the foregoing statement, it is observable that there are more trades carried on and manufactures set up, in the provinces on the continent of America to the northward of Virginia, prejudicial to the trade and manufactures of Great Britain, particularly in New England, than in any other of the British colonies; which is not to be wondered at, for their soil, climate and produce being pretty nearly the same with ours, they have no staple commodities of their own growth to exchange for our manufactures; which puts them under greater necessity, as well as under greater temptations, for providing for themselves at home." And in 1750, Parliament declared mills for certain kinds of manufactures in the colonies *common*

nuisances, and directed the governors, on information of two witnesses under oath, to cause the same to be *abated* within thirty days, or forfeit the sum of £500.

Thus early the people of New England, against the remonstrances and even commands of the parent country, established and carried on manufacturing. The business was continued and increased after the separation, and has been carried on under varying circumstances to the successful results of the present time. And now New England is known at home and abroad as the manufacturing section, as fully and universally as the West is known as the grain-growing, and the South as the cotton-growing sections.

The facts and results of this long experience, as well as the certain operations of natural causes, point to New England as the manufacturing centre of the country in the future as in the past.

The people of other sections may, to a limited extent, carry on successfully some of the coarser manufactures, in which but little skilled labor is employed, and may in exceptional times, as within the last few years, attempt with temporary success to establish other manufactures, but when the affairs of the country are brought back to their normal condition, it will be found that such experiments will result in failure.

The people of New England, with the advantages of the system of reciprocity throughout the country as in the past, will always be able to control the markets of the country in manufactured articles against any domestic competition, and largely, in time, against any competition from abroad; and with the future growth of the different sections, no man can calculate the proportions to which our manufacturing industries will expand, or the amouut of prosperity which their expansion will bring not only to the agricultural, but to every other industry of our section.

It is impossible for the people of the United States to overestimate the value of the system of government inaugurated by their fathers. Under it vast communities, which under other circumstances would have grown into independent nationalities, move in perfect harmony, each independent in the exercise of the rights of self-government, and all united in their intercourse with each other and with the world. And

this great political success is paralleled only by the material prosperity which the system has conferred upon the whole people. Instead of each community living upon and conforming its industries to its own natural productions alone, all, without restriction and without payment of tribute, bring the choicest products of their soil and labor to the common market.

Of the immense variety of productions, those that one section can furnish cheaper than the others it offers to all, and those which any section can purchase cheaper than it can produce, it buys of the others, and the people of each section concentrate their efforts on what they can produce to the greatest profit.

And may we not with confidence anticipate the day, when in the light of a higher civilization, the selfishness of communities will yield to the broader and nobler spirit of a common humanity, when all the nations of the civilized world will coöperate to abolish the offices of customs, to disband the armies of stipendiaries they support, and open wide the markets of the world under a system of universal reciprocity?

NEW ENGLAND FARMING.

From an Address before the Middlesex North Agricultural Society.

BY GEORGE B. LORING.

The agreeable duty of opening the annual exhibition of this society once more devolves upon me. Encouraged by the success of last year, we have returned to Lowell, out of our usual course, to receive the valuable assistance which a thriving manufacturing community is always ready to bestow upon that industry which we specially represent. In many respects the season which is just beginning to approach its close, when the results of our labors are to be estimated, has been unusually propitious. From early spring until now, the fields have been "in verdure clad," and the husbandman has been surrounded by all the luxuriance, which Nature in her most liberal mood could bestow. The long repose of drought seems to be broken, and the scorched and wasted land has returned with new vigor to its work of production. The tiller of the soil has received his full share of prosperity, and a new assurance that well-applied agriculture is as capable of securing an ample reward as any one of those more attractive occupations whose profits and uncertainties are equally great. The magnitude of this exhibition is of itself sufficient evidence of the esteem in which agriculture is held, and of the encouragement held out to those engaged in it. The collection of live-stock of every description is larger and more valuable than we have before witnessed on a similar occasion, bearing witness that no discouragement has yet fallen upon those who are endeavoring to improve the flocks and herds of New England. The specimens of agricultural machinery on these grounds have not been surpassed at any previous show, and indicate a determination on the part of our mechanics to keep

pace with the increasing demands for new implements of husbandry, and for those to which the best principles are applied. No discouragement has yet fallen upon the skilful and ingenious farmer, and no check has yet been given to his demand for the best means by which the labor of the farm can well be applied and the profits of the farm can be increased. I have thus far been led to believe that this association had roused and stimulated a vigorous and prosperous and important occupation to new vigor and increased prosperity and importance; and I see no reason why it should suspend its operations or abandon its field of labor in despair.

And yet, the picture of New England agriculture which is constantly presented to us is so discouraging that were it true, every man would be induced to abandon the soil, and every society like this would be wise to cease its operations and disband. In the midst of a thriving community, a large portion of which is devoted to agriculture; in the midst of a constantly improving system of cultivation; in the midst of multiplying instances of improved estates, and increasing herds, and profitable crops, the decline of New England agriculture is quietly assumed and believed by some, and so vehemently asserted by others as to make it appear that their special desire is its downfall. The abandonment of mountain farms and of landed estates, far removed from railway communication, and the decrease in certain crops, is constantly alluded to as a proof that agriculture in New England is dying out. We are told with an air of triumph that wheat and corn and oats and sheep and swine and flax and wool and potatoes are not as largely produced among us at the present time as formerly. We are also informed that the acres of improved land have diminished twenty per cent., and of unimproved land fifteen per cent., without being told what the remainder is, nor what is to become of a State whose improved lands and unimproved lands are to be equally destroyed. I am aware that a certain class of farms are deserted, and that certain crops are abandoned,—the former on account of locality, and the latter on account of their cheaper production elsewhere. It requires no great wisdom to prove that wool will grow spontaneously, as it were, in Texas, where no winter-feed and housing are required, cheaper than it can be grown

in New England, or even in the Middle States. It is easy to understand why corn and wheat and flax can be grown more profitably on the more fertile soil, and under the milder skies of the West and South-West. The production of beef and mutton on the rich pastures of Ohio and Illinois, is of necessity more profitable than it is in the short pastures and in the short summers and long winters of New Hampshire. And competition in these branches of agriculture would be as absurd and idle on the part of a New England farmer, as it would be for him to insist on rivalling the sugar and cotton growers of the South. He must conform to the necessities imposed upon him by soil, and climate, and markets, and the opportunities enjoyed by more favored localities than his own. But it does not follow that in doing this he is doomed to destruction. Neither is it the part of wisdom for him to adhere to the old system, however disastrous it may be, nor to reject the new, however prosperous.

Every farmer knows that the profits of a farm depend not on the number of acres cultivated, but on the amount produced from each acre to which his industry is applied. And the same rule holds good with regard to a State or a cluster of States. The signal for improvement on many farms has been the abandonment of a large surface, and the adoption of a smaller one, out of its aggregate tillage-lands. When we are told, therefore, that the number of acres of cultivated land in New Hampshire or Vermont or Massachusetts has decreased, while the value of the crops has increased, we can simply understand that the law which applies to a single profitable farm is applied to the general system of agriculture throughout those States. And we should not be surprised that the farmer should desire to be governed by the same rule which directs the manufacturer in producing goods adapted to the market he would occupy, or the merchant in his traffic in those commodities which are adapted to his channels of trade. I am not discouraged on this account, when I learn that, while the articles to which I referred have diminished, those peculiarly adapted to local markets, or to certain sections of our lands, have increased largely, and these alone. The growth of tobacco in the valley of the Connecticut River is the result of an active and vigorous observance of this law by the

farmers who occupy this locality, and have passed from one crop to another according to the demands of the markets and the competition they are to meet with. That this crop should have increased is as natural as that woollen and cotton mills should have multiplied on all our streams. So, too, of our market-gardening in the neighborhood of our cities and large towns. Wherever a demand has been created the supply has followed. And whether it be the products of the dairy or of the orchard or of the market-garden or of the vineyard, profit has always attended their judicious production. No farm fortunately situated as regards markets, in New England, has yet been deserted, nor has land thus situated decreased in value; on the contrary, the rise in the value of such lands for farming purposes alone has been enormous.

It is not difficult, moreover, to account for the decrease of certain crops which would seem, at first glance, to be stimulated by the state of things to which I have referred. Potatoes, for instance, which were formerly raised in large quantities, and easily raised, too, throughout all the sparsely settled portions of New England, for the manufacture of starch and as food for cattle, are now raised with much difficulty almost solely as food for man. No farmer can afford to raise potatoes at the present reduced amount of the crop on account of disease, if for no other reason, for the cheaper purposes of manufacture or cattle-feeding. The increasing demand for milk in the market has drawn a large portion of this commodity away from the production of butter and cheese; and as the amount of the latter diminishes, the value of the former is largely increased. That hay also should have fallen off in quantity, during the severe droughts and hard winters of the last four or five years, is not surprising, especially when you add to these causes the removal of abandoned farms from the hay-producing area of the country.

That the same ingenuity that is now applied to lands near a market will one day be applied to those more remote, and with less ready means of communication, I have no doubt. I have often urged an investigation into the method by which the grass-lands of New England, now lying idle, could be brought into the production of hay by the use of some effective fertilizer, and by some easy mode of cultivation. The

supply of hay is by no means equal to the increasing demand; and the price it commands in the market is often entirely out of proportion to that of other articles of food for animals. Hay-farms must be a modern agricultural invention, and will be as soon as capital and industry are carefully turned in that direction.

But is it a misfortune that the agriculture of New England is changing its character, and adapting itself to the present condition of our industry and population? The people of New England have not been in the habit of adhering to old associations and models of business in such a way as to "grasp their ruin in their bliss." As their towns have increased in number and population, they have gathered into and about them,—some engaged in the occupation to which the town was especially devoted, and some attending to the accessories of that occupation,—the traffic, the agriculture, the transportation which go with it. In doing this, they have carried with them all that enterprise and industry which gave our purely rural towns their character and prosperity. They have not only taken the places of trust and responsibility, with which a thronged and busy community abounds, but they have also surrounded these communities with progressive farming. Many men have left the remoter regions for the professions, for service in counting-rooms and on railroads and in manufactories; but many have also left the farming of those regions for the more careful, intricate and profitable work of tilling the land for specific purposes. And not without their reward. For you cannot show me a more prosperous class in the community than those devoted to special farming in its many and diverse branches. So far as this work has already gone, the result is worthy of all admiration. The skill and energy which it requires have stimulated all the faculties which attend the most active pursuits in life. The agricultural mind of the community has never been more thoroughly roused, nor more ready for investigation than now. It is not all idle talk,—this discussion of agricultural topics. The public appeals in behalf of this industry are not mere declamation. The establishment of schools for agricultural instruction are not all matters of mere fancy. The organization of agricultural societies is not solely an amusement. An

agricultural exhibition is not a mere show, nor are the days devoted to it mere holidays. But over all and above all there is a spirit of inquiry and progress, which is earnestly engaged in solving the agricultural problem in the best way, always remembering that the rules governing the occupation differ as localities differ.

The agricultural taste of the community is also improving. Not only are the farm-houses throughout New England, wherever occupied, in good condition, indicating the profit of those farms which are still under cultivation, but the evidences of an increasing desire for tasteful and well-ordered houses are abundant everywhere. And this taste has increased as the devotion to a careful and accurate system of agriculture has increased. In this respect the people of New England are doing their whole duty. They occupy such land as will reward them for their toil. They apply the same rules to their business as are applied to others. They retain what is profitable and reject what is not. And when they have been enabled to apply their best skill they have converted their acres into a garden which is alike creditable to their taste and their thrift. The growth of large towns in their midst has furnished them with opportunities for cultivation not enjoyed by their ancestors. And whatever may be the deductions from an array of statistics, the fact is evident to every candid observer, that in the midst of all the supposed decline the agricultural population of New England was never in a better condition than now. It may be that many young men desert the farms of their fathers for more lively scenes and more active duties; but it is nevertheless true that a farm well located has its attractions still, and is sure to find an owner. And I have no doubt that the time will come, when the sagacity and industry which find so ample a reward in other occupations, will discover the opportunity afforded by the agriculture required in a busy and growing and thriving community.

THE RELATION OF AGRICULTURE TO MANHOOD.

From an Address before the Worcester North Agricultural Society.

BY C. W. EMERSON.

I have selected as the subject of my address, The Relation of Agriculture to Manhood. Whatever is second in life, manhood is first. And I believe there is no other pursuit so well calculated to develop true manhood as that of agriculture. From agriculture has come almost everything that tends to the development of our civilization. Perhaps I could dwell upon no theme that would be more interesting than that of tracing the origin and the subsequent development of the arts and sciences from the necessities of agriculture. I think it would be shown that nearly all the arts and sciences had their rise in the needs growing out of agriculture.

Egypt is acknowledged to be the mother of science and art. Why can the principal arts and sciences be traced to Egypt? Because ancient Egypt was exclusively agricultural. Early history will bear us out in the supposition that Ham and some of his descendants emigrated to Egypt and settled on the banks of the Nile and colonized the whole of lower Egypt. The soil was very fertile, but there was difficulty in securing a crop on account of the inundations of the Nile. For a long time they found themselves unable to determine at precisely what time the inundation, which lasted between two and three months, would commence. At last, however, they discovered one of the most brilliant, though not the largest, of all the stars of heaven, just close to the horizon, where it shone a few moments before the rising of the sun. This star always made its appearance just before the inundation of the Nile commenced.

This star seemed to the ancients like a faithful watchdog, warning them of approaching danger, therefore they called it the Dogstar. And from this the Egyptians developed, as far as it extended, a perfect system of astronomy.

Prof. O. M. Mitchell stated in a lecture, a few years since, that he had met, not long before, in the city of St. Louis, a man of great scientific attainments, who, for forty years, had been engaged in Egypt in deciphering the hieroglyphics of the ancients. This gentleman stated to him that he had lately unravelled the inscriptions on the coffin of a mummy now in the London Museum. The zodiac, with the exact position of the planets, was delineated on this coffin, and the date to which they pointed was the autumnal equinox in the year 1722, B. C., or nearly 3,600 years ago.

Prof. Mitchell employed his assistants to ascertain the exact positions of the heavenly bodies belonging to our system on the equinox of that year, and sent him a correct diagram of them, without having communicated his object for so doing. In compliance with this the calculations were made, and to his astonishment, on comparing the result with the statements of his scientific friend, already referred to, it was found on the 7th of October, 1722, B. C., the moon and planets had occupied the exact points in the heavens marked upon the coffin in the London Museum.

The Egyptians dated their year from the rising of the dog-star, which they represented by the picture of a door-keeper with his key,—the one who opened one year and closed another. Sometimes they gave the picture two heads,—the one old, representing the expiring year, and the other young, to denote the new year. Thus were introduced the arts of painting and sculpture. Now we have already shown that the science of astronomy, and the arts just mentioned, grew out of demands created by the pursuit of agriculture. Because the farmer in Egypt needed to know the exact courses of the heavenly bodies, men were set apart and supported at public expense to study astronomy and keep people informed of their movements. At the same point commenced the office of the priest, for those thus set apart were ultimately looked upon as the priests of the power of Heaven.

But I shall not dwell upon the ancient bearings of this sub-

ject, but come down to its relations with our modern life, and its vital, every-day interests. I shall, in this address, not attempt to show the relations of agriculture to the arts and sciences which promote civilization, so much as to show the effect of the pursuit of agriculture upon mankind.

There are many elements which go to make up mankind; some of which I shall point out, and endeavor to show how the pursuit of agriculture affects them. First, health.

Health lies at the foundation of every other good. All great efforts of the mind, all productions of genius, have their root in healthy blood and abundant vitality. Morality and virtue might almost be said to be exponents of health. Old Dr. Johnson said, "A man is a rascal as soon as he is sick." Ralph Waldo Emerson says, "If Eric is in robust health, and has slept well, and is at the top of his condition and thirty years old, at his departure from Greenland he will steer west and his ships will reach Newfoundland. But take out Eric and put in a stronger and bolder man,—Biorn or Thorfin,—and the ships will, with just as much ease, sail six hundred, one thousand, fifteen hundred miles further, and reach Labrador and New England. There is no chance in results. With adults as with children, one class enter cordially into the game and whirl with the whirling world, the others have cold hands and remain bystanders, or are only dragged in by the humor and vivacity of those who can carry a dead weight." A good maxim would be, sacrifice everything to health. Sacrifice health to nothing.

Health is not to be sacrificed, but put to service. It is the bounding pulse that does the work and the thinking of the world. All the great schemes of improvement and reform are projected and executed by health. There is a difference between not being sick and being abundant in health. A man to perform much must not be merely free from disease, but he must have immense vitality. He must be able to sleep well and eat well and assimilate well. He must be possessed of plus animal life and spirits. Then working, planning and creating are means of the highest pleasure. Many good things are written about the rules of hygiene; gymnastic schools are established in cultivated society everywhere; but when everything has been said and done that art and science can do, the

results are put in the shade by what farming does in promoting health and vital energy in the farmer. The employment of the farmer gives him in his varied labors just the exercise that develops harmoniously the muscular system. The vital energies are augmented by constant exercise in the open air. He becomes used to all kinds of weather and all degrees of cold and heat, until the vital powers of the system can not only defy rain, snow, hail and wind, but use them in enhancing their own powers. The cold that drives the city boy shivering into the house, causes the farmer's boy to leap and laugh with physical joy. To the latter the coldest January morning is the most exhilarating stimulant.

Second. Farming promotes a manly feeling of freedom and independence. He that has conquered severe climates and the hostile elements, is not to crouch before crowned heads or earthly sceptres. Nature is free, and the farmer who has dealt with her until she has imparted to him not only the fruits of her field, but the free atmosphere of her mountains and the spirit of her laws which spurn at human control, will never bow beneath the yoke of tyranny. Nature is self-reliant and so is the farmer. He would rather die than beg. This feeling grows out of no false pride, but from the lesson Nature has taught him, to earn what he would possess. That in the farmer's hands which he has not earned is to him a coal of fire. Nature allows no shams, and the farmer can allow nothing which looks like mere ostentation and display. To him use and beauty are always combined. He loves to have things exact. He wants pay for just what he parts with, and nothing more. It is not the farmer's half-bushel which has a false-bottom in it. Exact weights and measures are his especial delight. The farmer sometimes attempts to cheat the speculator I am aware; but he learned the lesson, not from his employment, but from having often traded with the speculator. I think it was Napoleon who said, "Do not go to war too often with the same nation, or you will teach them your art, of which they will take advantage to your hurt." I have sometimes thought this caution might apply with equal force to speculators concerning their deal with farmers. Plain-dealing, plain words, and plain dress characterize the farmer, for Nature has taught him to be like herself—simple.

Third. The pursuit of agriculture tends to develop the intellectual faculties. There is a notion current in the popular mind that a man who cannot succeed in any other pursuit should be a farmer. But this is a sad mistake. There is no pursuit that requires a fuller share of the elements of success. The farmer must have practical intellect, accurate judgment, and keen perception. Men of less practical ability may follow some business that requires the same strokes every day until it becomes a routine, and they follow it with as little thought as the horse moves in the treadmill. But the farmer is obliged to think about his work every day and every hour. His judgment must be good, for he must trade as well as work, and a few poor trades are fatal to his success. He must also be capable of laying plans for the future. It is a common remark among farmers, "He was good to work, but had little calculation, and failed to pay for his farm."

Farming is most emphatically a mathematical business. No man needs a scientific education more than the farmer. The farmer must be what is termed a posted man. He must understand the practical questions of the day, because there is hardly a question of the times that does not affect the market. He must have a keen foresight that he may be able to decide whether dairying or wool-growing will be most profitable for the next five years. The successful farmer must be a man of the most unfaltering perseverance, for his money is made slowly and by careful, patient endeavor, year after year. The hot blood and fever-pulse of ambition are of little account to him.

Let no one advise an enterprising and gifted young man to go into some business above farming, for there is nothing *above* farming. The work of the farmer educates the worker. A striking example of this is found in the effect this pursuit has upon our Irish immigrants. They come here with spirits crushed by ages of tyranny, bearing upon their brows the impress of the iron heel of despotism. Yet a few years' residence upon our freer soil, under the influence of our free institutions, develops some of the noblest specimens of manhood. But this is more apparent among those who select farming as a pursuit, than among those who take some other branch of employment. Notwithstanding the truth of all we

have said for agriculture, it is nevertheless true that farming to-day is not what reason teaches it ought to be. It is a business of which the resources are yet latent, and they remain latent in great part from the fact that mechanics and trade are draining the farms of the chief enterprise of the country. Young men aspire to some other business, at which they can get rich faster, and thus farming is left to the unenterprising and the immigrants.

Farming requires the application of more thought. Thought discovered a new Massachusetts under the old Massachusetts. Thought has put the ploughshare beneath old New England, developing the rich subsoil, so we have a new New England, and this soil of the new New England is found to be richer than that of the old New England. Drainage has discovered the best soil where it was supposed nothing more useful than alders would grow; and irrigation defies the drought caused by the clearing away of the forest. But there is another problem to be solved. It is, What shall recompense the soil for the constant drainage of her wealth in the products that go to supply our manufacturing towns? When we look into the East, at the exhausted soil of Assyria, and then at the process that is rapidly bringing our own soil into the same condition, the contemplation seems alarming. Look at Boston with its quarter of a million of inhabitants, besides the horses kept there; at New York with one million of inhabitants, and then at the smaller cities and villages, and you see at once that they are devouring all the wealth of the soil at a rapid rate, because for all the provisions they take from the soil they give nothing back; but all the manure which should be produced by this consumption is carried off through the sewers into that great washbowl—the sea. Here is a vital question, upon which every other question that pertains to the well-being of humanity hinges. How shall this tide of sewage be turned back to the soil whence it came? Assyria gives us the picture in her sparse, sick, starving inhabitants, of what this whole beautiful continent, so full of health, wealth and intelligence must, though not in our day, ultimately become, unless some system of fertilization shall be developed, which shall give the soil as much richness as has been taken from it. If this process of exhaustion, now going forward, is

allowed to continue, it will come to that at last, that nothing but a great upheaval of old Ocean's bed, forming new continents laden with that rich deposit, which has been accumulating for ages, can perpetuate the habitability of the earth. Geologists teach us that such upheavals have taken place in the past, but that the earth's crust is so thick they never can again.

Fourth. The pursuit of agriculture develops the poetical sentiment. The farmer does not write his lines in ink on paper, but on broad lands with plough and spade. His imagination is inspired by the growth of vegetation, the waving of grain, and the development of animal life, as he sees these things on the farm. Farming does not develop that dry, utilitarian life that many think it does. No other pursuit has so much of the spirit of poetry in it. Who is that poet who, above all others, carries cheer to the hearts of the people of Scotland, England and America? It is he who said "Thankit be God I can plow." Burns was the farmer-poet. Margaret Fuller, in a critique of hers, on the earlier poems of Longfellow, said, in substance, that his verses were inspired by the study and not the field. But Robert Burns was the genuine son of the soil, and his immortal lines are true to Nature, and thrill a responsive chord in the heart of every one of her lovers.

Fifth. The pursuit of farming develops a healthy moral sentiment. Many who leave a country life in youth to enter the more public walks of life, and gain wealth and distinction afterwards, do so oftentimes at the expense of those moral qualities which could have been better preserved on the farm. The course of James Fisk, Jr., is an illustration of this—his own words judging him—when he said, for a long time the only alternative before him was a prison or a palace. Nature is moral, and she breathes morality into those who work and commune with her. The success of business and professional men is more nearly related to morality than every one thinks. Nothing develops the elements of success like agriculture.

Most of our distinguished senators are the sons of farmers. In the face of the immortal Webster you could see the mountains of his native New Hampshire. Finally, we affirm that the pursuit of agriculture tends to develop the religious senti-

ment. Nobody so well as the farmer knows that God is the source of every material blessing. The mechanic or the merchant when he purchases bread looks upon it as that which dollars and cents buy. The farmer knows that his field of grain was not bought with money, but "It is God that giveth the increase." Of all our anniversaries, none so important as Fast and Thanksgiving days. The observance of one day in every year for public fast had its origin in Egypt in a remote period of human history. The ancients fasted and prayed, just as the days were the shortest, when, as they thought, the sun had been dragged by the powers of darkness far down in the south, that God would bring back the sun, and thus insure them another harvest, and save them from starvation. Then, as now, agriculture taught men to fast and pray. The custom of thanksgiving holds a prominent place in the hearts of the people. Once a year our New England families are gathered around the family board, and at this time, if at no other, we feel that it is God who has given us this bountiful harvest for which a day has been appointed of thanksgiving and praise. All feel then that the abundance they enjoy is not merely the reward of toil, but that which they receive only by the grace of God. Thus we are led to say, others may be good, in spite of their occupation, but the very toil and experience of the farmer teaches him the great truths of religion and morality.

DOES FARMING PAY?

From an Address before the Hampshire Agricultural Society.

BY LEVI STOCKBRIDGE.

Your association was organized and has been supported by public appropriation, by private donations, and much hard labor, for the purpose of stimulating, fostering and improving the agriculture of this section of the State, to the end that both private and public wealth may be advanced. And it seems to me that any one who has carefully noted the changes that have taken place during the last twenty years in our farms, our farm-houses, barns and their surroundings, in the pecuniary condition of our farmers, in their general intelligence, in their knowledge of and success in their business, must be satisfied that in a good degree these results have been attained; yet the question is being continually asked—"Does farming pay?" Within the last six months it has been often discussed in agricultural journals, and has been answered in the negative and affirmative in about equal proportions. And the debate is yet going on, as if it were a new question, and the relations of agriculture to private prosperity and national wealth, and the value of labor and its results in this department, were little understood. Taking a broad view of this matter, the decided presumption is that farming pays. The sum of the nation's present wealth and its annual increase is solely the product of its producing industries,—those which create valuable new material, or which put that material into form and place needed to supply human want. Simple exchange, even if dignified by the name of commerce, adds not a farthing to the accumulations of the producers; and there are many callings, pursuits and professions, acknowledged to be laudable and honorable, which contribute nothing to the

general store, except as they may incidentally aid to make the producing-labor of others more efficient and powerful, and from this they must be supported.

Agriculture is acknowledged to be the chief among our great producing industries. Labor in this department is fundamental, in that its products are a new creation of indispensable and valuable material out of that which previously was valueless. Nor is this all. So indispensable are its products of raw material that farmers have absolute control of all other industries. So imperative are the wants for his food-products, and so unchanged is this demand by trade fluctuations, by whim, caprice or fashion, that the last farthing, if not the very life of all other classes, are at his disposal. Therefore, it is to be presumed that farming pays; and if it does not, it must be the fault of those who pursue it. If a pursuit which is fundamental to everything else, whose products under any circumstances cannot be dispensed with, does not give fair remuneration for the labor expended upon it, a great wrong exists somewhere, let that pursuit be what it may. As already stated the great aggregate of the nation's wealth is but the result of private prosperity and gain. Therefore, a wise and parental government especially aids, encourages and protects those classes of its citizens whose labor as individuals tends primarily to this result. Our question should therefore be examined and answered from two stand-points: First, Does farming pay the nation? Second, Does farming pay the individual? For it is possible that, owing to adverse circumstances, or to some improper system in the distribution of the products of labor, the nation may be growing rich, while the great mass of laborers are growing poor, or do not obtain just compensation for their toil. And first, Does farming pay as a national industry? I answer, Yes. No other industry creates *absolutely* so much useful material and wealth as farming. This is most conclusively proved by the statistics collected by the different departments of the national government in the census of 1870. The returns show that we have 406,735,041 acres of actual farm-lands, improved and unimproved, exclusive of lands in cities and villages. Allow that this land was worth to the government one dollar and twenty-five cents per acre before its value was enhanced by agricult-

ural labor, and the aggregate amount would be $509,668,801. Now their actual cash value, as returned by the assessors of that year (and it is a low estimate) was $9,262,803,861. In other words, farm-labor has added to the landed wealth of the nation $8,753,135,000. The same returns make the cash value of our farm-fixtures and stock $1,862,154,886, swelling the grand total of agricultural contribution to the inconceivable sum of $10,615,289,646. This, it should be noticed, is its accumulations, and is distinct from its annual productions. This amazing sum is the permanent capital of the state, and its peculiar character is really of more importance to it than the amount. The other property of the nation in individual hands—money, bonds, notes, merchandise, real estate of towns and cities—is good of its kind in ordinary times, when everything moves smoothly, and is available for government use ; but in great emergencies—in times of national convulsions and war—when the vital strength and enduring power of the state is brought to the test, this class of property disappears, or is unsuited to the occasion ; but the value of the farming-lands and their power of production become the real-estate security which sustains the nation's credit at home and abroad, and enables it to recover from the greatest disasters. France, at the present time, is a good example of this. Crushed, subdued and devastated by the great military power and armies of Prussia, laid under enormous contributions to pay the war expenses of both countries, we are astonished at her unimpaired credit, and the rapidity with which she is repairing her manifold injuries. This is not the influence of the capital or products of her commerce or manufactures, but the result of long years of wisely-directed effort in creating a nation of skilful farmers, and raising her farming-lands to the highest point of value and power of production. The aid which farming gives to the nation's regular prosperity, to its annual products, is no less marked than its influence on its permanent capital. In fact, the former, to a great extent, is the result of the latter. Referring again to the last census, I find the appraised value of all kinds of farm-products of 1870, while in the hands of farmers, and before any value was added by transportation or dealers' profits, was $2,515,593,076. This is the result of a single year's work on

our farms, and so quietly was it done, so silently did the ingathering go forward at ten thousand different points, that this enormous value was stored almost without the notice of the bustling, clamorous world of trade and manufactures. That very year they besieged the government for special privileges and direct aid by the adjustment of the tariff, the opening of new lines of communication and new marts of traffic, though the value of their products, as the result of labor bestowed on raw material, if we include all the leading manufactures, cotton, woollen, boots and shoes, and all iron products, was small compared with the products of farms; and the government itself hardly recognized what was going on until the great result was spread before it. I have not been able to obtain the official report of our manufacturing industries of that year, but they will probably show about the same proportion as at the previous census, when the value of our farm-products was more than the greatest of them, and about equal to them all.

But again, farming pays the nation by its contribution to our foreign exchanges. Every nation should strive to supply all the wants of its people just so far as its soil, climate, natural advantages and mechanical skill will allow, but should always produce that which under all circumstances it can do most advantageously. But in any event, it should sell more than it buys, or it will end in bankruptcy. The wants of a community of savages are few and easily supplied; but as they ascend in the scale of intelligence and civilization, their wants rapidly increase, requiring a large field, a varied climate, and educated skill, to procure the means of their gratification. The people of the United States stand on the highest plane of civilization, and have a legion of wants, real and imaginary, which are fostered by our national ambition and extravagance to such an extent that we have become—according to our wealth and population—the largest purchasers of foreign products and commodities of any nation on the earth. We send our commercial marine to every nook and corner of the world, explore all lands, and make ourselves acquainted with the peculiar productions and manufactures of all people; and, unlike Old England, not so much for the purpose of selling our own surplus, as to buy of theirs. We import choice

fruits from the tropics, sugar from the West Indies, tea, toys and "gimcracks" from China, silks from France and Japan, hides from South America, iron from England, Norway and Russia; and in fact a thousand other articles which we can and should produce if we use them. To such an extent has this mania to covet, buy and consume foreign articles been carried, that in a majority of years the balance of trade has been against us; and but for our production of gold and silver, we should have been compelled, for aught I know, to go into an assignment, and have our national estate settled in a bankrupt court. Bad as the case now is, it would be immeasurably worse but for our farm-products. In this emergency it is not the manufacturer, the miner or the fisherman, but the farmer who supplies the exportable commodities to liquidate the foreign claim. For eight months ending the first of March, 1872, we imported commodities of foreign production to the value of $391,670,674, and if the trade continues at that rate for the remainder of the year it will amount to $587,506,011. For eight months ending at the same time, we exported domestic products to the value of $352,123,115. If the exportation continued in the same proportion to the end of the fiscal year, it would aggregate $529,184,672,—an enormous sum; but we should still have a foreign indebtedness of $59,321,339. But let us analyze this domestic exportation, which paid $528,184,672 of our debt, and see who contributed it,—by whose labor it was produced. The custom-house returns for the period named, show that our mining and fishing interests, our manufactures of cottons, woollens, boots and shoes, of iron and steel of every description, clothing, of silver and gold, gold and silver coin, —manufactures of every kind and grade in the country all combined,—furnished for exportation with which to pay the foreign debt, products to the value of $134,625,087. And the farmers furnished corn, wheat, flour, cotton, beef, pork, lard, live-stock, fruits, butter, cheese, and other products of the soil, to the aggregate value of $393,559,585. Thus it appears that so far as our trade, exchanges and indebtedness to foreign nations are concerned, so far as our ability to pay, our solvency and credit are concerned, the farmers contribute more to discharge the one and uphold the other than all other

classes and industries. I come now to my last argument proving that farming pays the nation. And that is, its influence in fixing the national type of character, the Americanized sentiment of our population.

As might be expected from the sum of the products, nearly one-half of our population are engaged, either directly or indirectly, in some branch of agriculture, and much more than half of our producing-laborers are at work upon the soil. By the returns it appears that on the first of June, 1870, there were in the United States 9,486,307 persons actively engaged in gainful pursuits. Of these, 2,407,421 were engaged in manufacturing, mechanical and mining pursuits; 5,928,868 were engaged in agriculture, and the remaining 850,018 were engaged in transportation, the different professions and minor industries. Thus it appears that so far as our population and industries are concerned, we are really a nation of farmers. This is the paramount and controlling interest, and, in all its needs, simple justice, as well as public welfare, demand that it shall receive the constant care of the state. The vital and enduring power of a nation depends very largely on the homogeneous character of its people and their attachment to their fatherland. But we are, as it were, a nation of immigrants gathered from all the countries of the world,—of different and often opposing religions, reared under different forms of government, and retaining to a great extent national prejudices. These are elements of weakness, and history would teach us that when the time of trial came, the ties which bind these individuals together as a nation would be but ropes of sand, and we should fall to pieces. The fact however has proved far otherwise; once, again and again, we have passed through the most terrible ordeal, and found that notwithstanding the incongruous character of our people, we possess as much inherent strength as the most favored nations. How is the anomaly in the world's history to be accounted for? Mainly by this simple fact: That when the German, the Frenchman, the Irishman, the Italian or the Englishman immigrate to us they are transformed from tenants or serfs into land-owners. Of a sudden they find to their astonishment that they have become an inherent part of the nation, that they *possess* the soil which is their home, and which cannot be alienated or

taken away but by their own act; that, as never before, they are men with hopes, rights and interests to labor and to strike for, that instead of being simple spectators of government affairs, they are themselves a part of the government. And they rally round the national banner, as the emblem of the power that has conferred and protects them in their new rights and privileges, with a love and enthusiasm as ardent but more vital and enduring than their love and attachment to the land of their birth.

Whether they were conscious of it or not, the men who originated and passed the Homestead Act, acted the part of philosophic statesmen. Land to the landless, free homes to those who settle upon and till the soil, whether in the original form of nominal purchase, or the present form of absolute freedom, is the grand stroke of American policy which obliterates the diverse national prejudices of our immigrants, and binds them together as a homogeneous and indissoluble nation. But the influence of farming on our people does not end here. We have some national characteristics that are not desirable, and if they were not checked or toned down, would result in great evil. We are extravagant and wasteful; we are continually aping foreign ideas, customs, habits and fashions; we are prone to go wild in our business enterprises and speculations; we have a mania to get rapidly rich, and are not over-scrupulous as to the means employed. We are excitable, running up to fever and boiling heat over the current events of the day, politics or religion, and ready to shout for the last ism that has been concocted. These traits of national character have their principal development in our cities and large towns, where the population is dense and engaged in commercial and manufacturing pursuits, but rarely, or to a very limited extent, among our rural population. In this respect the farming community is the hope of the nation, as the conservator of our public morals, the controller and moderator of these extravagances, the sheet-anchor which holds the ship to her moorings, how hard soever or from what quarter the tempest blows, the ballast and rudder which keep her in position and send her surely and steadily on her course. These are some of the ways and the extent to which farming pays the nation; and I may add, as including all, that if national life

is desirable it pays, for though you might blot out either of our other great industries without fatal results, yet if agriculture were extinguished the nation itself would die.

We pass now to our second consideration: Does farming pay those who are engaged in the occupation? And here I admit, at the outset, that there are some men whom farming does not pay. Neither would any other occupation, pursuit or profession. Some men are so constituted that everything they touch turns to poverty and leanness. They might dig in the richest placers of California or Nevada, or the most marvellous diamond deposit of Golconda, and yet they would be poor. Then there are others who set such a priceless value on all their efforts, both mental and physical, that hardly any compensation reaches their standard of deserved return. Others look at this matter from an artificial or fictitious stand-point, and of course come to very erroneous conclusions. They notice that some individuals become suddenly wealthy in other business, or without business, and jump to the conclusion, without analyzing the case, that that is the thing which pays, while their own business does not. Some have an insatiable longing for wealth, but are utterly averse to the labor, care, responsibility and frugality absolutely necessary to acquire it honestly. They are after some business that *pays*, and are not over-anxious to know that its prosecution is advantageous to the community. Now the honest truth is, that none of these classes will find farming a *paying* business, unless their views are materially modified; and they had better not engage in it. The latter class, not being able to appreciate the fact that no business *pays* except that in which honest labor creates a value, might as well make a clean breast of it, and plunge into some wild scheme of speculation, where, having nothing to risk and nothing to lose, there may be one chance in ten thousand to win; or better yet, engage in manufacturing money on their own account, or by a single night's stealthy toil, get possession of some great deposit of bank-notes and government bonds, which would decide the question of what pays. On the other hand, there are men of whose schemes, plans and forecast we can know but little, but of whom it appears that everything they touch, and much which they do not touch, is turned

into gold in their coffers. They seem to have a magnetic power, which causes wealth to flow to them without act or volition on their part. Farming pays such men. In relation to secular affairs, no more erroneous or hurtful idea was ever entertained than that *any* business, in and of itself, ever did or ever can pay. The fact is, everything depends upon the man. In ordinary cases he controls the situation, and is a more important element in producing results than the mere pursuit. For an exact understanding of this subject, therefore, we should, just as far as possible, discard these extreme cases on either side, and ascertain, if we can, if the soil does not return a paying value and support for average labor and intelligence expended in its cultivation. If we knew nothing of the minute details of the matter it would be fair to presume that it did, for two reasons: First, because that from the very nature and constitution of our being, the tilling of the ground is, and must forever be, the occupation of much the largest portion of our race. This was planned by the Great Designer, and it cannot be that it was in'ended in any sense to be unrequited toil; but on the other hand, that it should, all things considered, abundantly reward all the labor required. And second, because in agriculture, the workman, if he knows his business, need perform but half the labor. He is simply a co-worker, a helper. If he but plan aright, Nature's powers and forces enter the field and delve early and late. Tirelessly, they work on, whether he sleeps or wakes, and the grand results of this gratuitous labor are all his own.

Now let us examine the facts and see if they do not fully sustain the presumption; and take the whole United States,—a field broad enough to include good and poor farming, the wise and the foolish, the thrifty and the thriftless, the sections of good markets and crops, and poor markets and crops; those who farm with the best advantages and those with none,—and see if under these unfavorable circumstances farming does not pay for the cost of carrying it on, and a rich per cent. for all the capital invested. To ascertain this with any degree of exactness, we must know the sum invested in all the farming-lands of the Union (in other words, we must know their present worth), including unimproved land and farm-

buildings. We must know the amount of capital invested in all farm-implements, vehicles and machinery. We must know the actual value of products on the farm before a new value is added by transportation. And we must know the entire cost of producing the crops. The cost taken from the income, and the remainder divided by the capital, will give us the per cent. of interest on the capital invested. I make the statement so that the process by which I obtain my somewhat remarkable result may be perfectly understood. Now the entire capital invested in farm-lands and farm-buildings, of every description, in farm-stock of all kinds, in farm-implements, vehicles and machinery, is $10,615,289,946. The gross annual income from this capital is $5,515,593,077. The total cost of all labor and board is $413,711,713. Labor and board is actually more than half the cost of growing of crops, but we will call it half, which would make the total cost of producing this income, $827,423,446. The cost, taken from the gross income, leaves us $1,688,169,620 as the net profit of our agriculture, and this, divided by the sum of the capital, gives us fifteen and three-fourths per cent. on our whole investment. But some one who has not seen this fifteen per cent. may object; if so, I reply it must be because capital is but the surplus earnings of labor. Eventually farm-capital is the surplus of farm-labor, and if it did not more than support itself it could not have accumulated the inconceivable sum of nearly eleven billions of dollars. But the objector will answer, "Many of our farms are mortgaged." But most of them are not, and here is my strong argument. We all know that these are the kind of mortgages that are rarely foreclosed. They have been bought by young men with little capital, and the farm held for security. But these men will, out of the profits of the farms, pay their interest-money, pay their taxes, defray their heavy expenses of rearing and educating their families and the demands of society, and liquidate their debt and own their land in full, as thousands of such have already done, and present indisputable proof that farming pays. Back again, however, comes the objector, and says, "How about that fifteen per cent.; I don't find it?" Well, very likely you don't, but you ought to, and to be able to put your hand upon and show it. You may depend upon it,

5

my friend, that fifteen per cent. "is lying around loose" somewhere, and you had better ransack the nooks, crannies and by-ways of your business until you bring it out to the light. There is a range in the per cent. which farm-lands will pay in different hands, management, and under varying circumstances. I know of lands in this valley which are paying all the expense of their cultivation and a hundred per cent. on the capital; and there are some which are *held*, but not *farmed*, and are so treated that Nature herself is foiled in her attempts to produce crops which pay anything. In the latter case it is neither the fault of the land nor the business, but entirely that of the owner, for there is but little land east of the Alleghanies but what if left entirely to itself, without thought care, or oversight of the owner, would yield him six per cent. and taxes by the growth of wood. These considerations lead to the settled conviction that farming pays the individual in dollars and cents for all the intelligence and labor he gives it. Statistics (which I will not take your time to quote) prove, conclusively, that of every hundred persons who engage in trade, more than ninety fail. But of persons who engage in farming, and do not meddle with outside business, not one in a hundred is ever bankrupt; and a hundred young men, taking farming as their business, will aggregate more wealth than a hundred in any other business. With the former the aggregate will be pretty evenly divided, each will have a competence, but with the latter the aggregate of wealth will be divided among a very few, and a great majority will obtain but a bare livelihood.

But dollars and cents, however desirable and useful, are not the whole of life. There are some things desirable and useful, and which money cannot purchase, which are inherent in the farmer's occupation and a part of his reward, which should be taken into the account. From his position and the nature of his occupation, he is exempt from the whirl of excitement and corroding cares of the moneyed and commercial world. He is measurably free from their fluctuations, panics and disasters. The blessed comforts of stability and security are his when revulsions come upon most pursuits, and stock and mercantile fortunes disappear as the dew. Of the whim, caprice and fashion which often thwart the best-laid plans of

the manufacturer and mechanic, he is a stranger, and if general disaster come upon the business-world, the sustenance and comfort of his family are provided by his own products, and he may rejoice in his independence and comparative freedom from the ruin. The nature of his calling removes him to a great extent from the intrigue, finesse and double-dealing of the most depraved of mankind. He is a co-worker with kindly, genial Nature, whose laws, principles and mode of action he may study and understand, receiving abundant compensation from their elevating and expanding influence. The prevailing impression that farming does not pay, is not obtained because of the actual fact, but because, as a general rule, farmers keep no accounts which show whether their business is conducted at a loss or profit. They cannot tell, at the year's end, whether they are worth more or less than they were at the beginning. And whatever may be the result, they know not whether it is due to their farming or to matters which are, and should be, kept entirely independent from the farm. I therefore close this subject with some suggestions respecting farm-accounts, which, if complied with, will tend to show to each individual farmer the result of each year's operations, and whether it pays him for his labor and capital. The *business* of farming and farm-accounts have nothing singular or intricate about them, but should be conducted and kept in the same manner and on the same principles as that of the merchant or manufacturer. The farmer should, every spring, take a perfect inventory and appraisal of everything connected with his business, that he may know how much capital he has invested. This inventory should include all his farm-lands, improved and unimproved. All his *barn*-buildings, but not the house. All the live-stock growing, or working exclusively on the farm, but not such as is kept partially or exclusively for the pleasure, comfort or convenience of the farmer's family. It should include all the tools, implements, machines and vehicles kept for farm-use, but not those vehicles kept for the pleasure or convenience of the family. In carrying on the year's operations, the farmer should charge to the farm all the manures and all the seed of every kind and description which he uses upon it; all the cost of labor hired, the value of his own labor and superintendence,

and that of his family when actually employed on the farm or about its business; and this should include board, whether paid for or received in the family. He should charge to the farm the cost of necessary repairs to all implements, vehicles and buildings that are used exclusively for farm-purposes, and all expenditures for labor or material in making farm-improvements. On the other hand, the farm should be credited for everything it produces at its sale-value, whether it be sold or consumed by the farmer's family, for the support of all animals kept for family use, and for all timber and fuel sold or used. The account thus kept, and the inventory and appraisal made the following spring, which must include the value of all crops and manures on hand, the value of all farm-improvements and wood grown, will show the result as a business operation, and the sum and per cent. of gain or loss. It will be noticed that this inventory and account makes a clear and distinct separation of the individual's business from the support and maintenance of his family and his outside expenditures. It is the only correct method, and is precisely like that of an intelligent business-man engaged in mercantile pursuits. The point is not how much money does the farmer have left after he has expended all he wishes on the pleasure, whim, fashionable desires or necessities of himself, his family or friends, but does the business pay for the labor expended and capital invested, and that such an account will show. And it will show a great deal more; for as it takes cognizance of daily operations, it will exhibit the elements of success and failure, bring prominently to view the leaks and wastes of the business, change that which before was a simple surmise—a guess—into a certainty, and enable the farmer to intelligently change and direct his business movements, when necessary, so that loss may be averted, and larger remuneration may be received for his labor, and a higher per cent. for the capital employed.

RESOURCES OF MASSACHUSETTS.

From an Address before the Deerfield Valley Agricultural Society.

BY WILLIAM CLAFLIN.

The reputation of the people of this part of the State for enterprise has always been of the highest character, and this beautiful and successful exhibition of the products of the farmer shows that there is no diminution of energy in its inhabitants. As we look around we see evidences of the steady increase of wealth and the growth of culture in the community.

Not on the seaboard alone, or in the great manufacturing centres is this advance manifest, but our interior towns and villages also, show that the causes of prosperity in a community are general, and that each part will share in their benefits though not always in an equal degree.

What then are the sources of the vast increase of population and wealth in our borders,—an increase so great as to enable us to retain our relative position, the seventh, according to the censuses of 1860 and 1870, in the list of the States?

To answer this question fully would take much more time than can be devoted to it in the brief period allowed us, but I may indicate some of the principal advantages possessed by the inhabitants of this Commonwealth:

First. Our location is most desirable, bordering as it does on the ocean, with a long sea-coast, abounding in excellent harbors; the world is open to the enterprise of our people. It is traversed by numerous rivers and streams which furnish water-power of incalculable value to our prosperous manufactories.

Second. Its climate is most healthful and invigorating,

enabling its inhabitants to perform a great amount of labor, both mental and physical. It is surrounded by thriving and prosperous communities of like character and pursuits, and strongly allied to its people by family association and similar interests. Here the Pilgrims landed and gave to the world those institutions which have done so much to enhance the intelligence of the people of the State and the whole country. Every descendant of these men, wherever located, feels the deepest attachment to this early home of men who displayed such knowledge of human nature in the establishment of government and such self-sacrifice of things present in the confident faith of benefiting in the highest degree the millions who were to follow them in the long future.

Third. Taken as a whole, its soil is excellent, though considerable portions are unfavorable for cultivation, yet these portions are not barren, for they are covered with valuable forests, supplying timber and fuel, useful in every community, and tending also to keep up the supply of water in the streams, especially important to our manufactories.

No man can calculate the value of these streams. England stands aghast to-day at the prospect of the failure of her coal-supply—the source of her motive-power, and I may add of her remarkable prosperity. It is true, as compared to the fertile States of the West, Massachusetts would seem to be poorly adapted to the sustenance of a large population, but we must remember that previous to the opening of the great lines of communication to the West, the people of New England were almost exclusively devoted to agriculture, and Massachusetts had nearly as many inhabitants to the square mile as the great State of Illinois in 1870.

This shows that the State has great natural capabilities of soil sufficient indeed to support a very large number of persons in comfort, and at the same time afford them facilities for moral and mental improvement.

With these advantages it is not surprising that a State should be filled with a people renowned for their activity, energy and success, but when is added to these a form of government most broad and liberal, with checks and balances guarding carefully the rights of the citizen, we can fully see the reasons of the mighty growth of population, wealth and power which are manifested on every side.

The founders of the State had suffered much from the bad government of their native land, and especially from the caprice of monarchs. They sought, therefore, to protect themselves here from the evils of personal rule, by placing around their magistrate councillors whose advice and consent must be obtained before any important measure could be passed or any important office filled, either in city or State. These councillors are now chosen at the same time that the governor is elected, and are like him responsible to the people only. This principle was carried by the founders of the State into all their administrations.

Herein is our safety as a community, and from this comes our freedom from fraud and peculation which have been so rife in other Commonwealths. The danger to liberty in any nation comes from the one-man power. This was fully understood by our fathers, and let us see to it that under no pretence shall the power of any high executive office be increased. The inquiry will be made, doubtless: What has all this to do with farming? The answer is that nothing is more necessary to insure the prosperity of the farmer than a stable and economical government. In other occupations the product of labor is immediate. The merchant and manufacturer get their returns usually twice in the year, but the farmer can have only one chance for a profit. He must lay the foundation of his business by annual outlays for many years, by clearing off forests, reducing the soil to a suitable condition for planting crops, in setting out orchards and draining and improving the land for the cultivation of grasses. Though the return for his labor is sure it is slow, and disorder and disturbance are ruin to him.

If there is a political commotion and frequent change in the government, he is the first to suffer, for his property is visible and subject to inroads, and at any rate, to the full burden of taxation. His prosperity is assured only in peace and order, and extravagance in public affairs is felt by him most keenly. For these reasons the farming community are careful in the public expenditure and alive to the public interest.

All honor to them for the public spirit always exhibited, and never more conspicuously than in the great rebellion.

Essential to a farmer's success is a thorough knowledge

of the crops likely to be profitable, and the best methods of their cultivation.

The State has reaped incalculable benefits from the opening of the great lines of communication to the West, bringing as they do all parts of the country into closer relation, and developing the wonderful resources of the country; still, there is the fact that the New England farmer has been driven, by the competition which he has to meet from these facilities, from cultivation of his usual crops to seek others which will remunerate him for outlay. Such radical changes involve much care, anxiety and occasionally loss; the result is that many persons prefer to work on in the old way, in the hope of a favorable change, until experience teaches them that they must abandon the old methods, or abandon the old farm; often they become discouraged and leave their homes where they have enjoyed so much, seeking for other places and employments, in the hope of bettering their condition, but which, alas, they seldom succeed in doing.

If they possessed ready means of learning the new processes of culture, a knowledge of the best and most profitable crops to be raised, they would remain and adapt themselves to the new condition of things. But here lies the difficulty. No one can be readily found who is competent to instruct them, and they cling to the old methods. Few persons comparatively in the community have more information than such as they have gathered by daily experience. Hence the necessity of agricultural schools and colleges. They should have the fostering care of the State; for what population is so essential to its future prosperity as its agriculturists? From them are to come the energetic, clear-headed men who are to direct the vast enterprises of the Commonwealth. Every assistance possible should be given to sustain and increase the opportunities of success. In no occupation is there such general interest. The prosperity of the farmer underlies that of all other professions, and they should be ready to contribute for the support of institutions which promise to benefit him.

Recognizing the justice of this principle the State has established an Agricultural College, which thus far has been very successful.

Two classes have graduated, with much credit to themselves and the institution.

These young men will soon spread the knowledge acquired by four years of study, under excellent teachers, through the community, enabling any who desire information to obtain the best in the country. Much has been done for the college, but much remains to be done to give it the position in the country enjoyed by the other educational institutions of the State. From my experience, I am led to believe that the legislature will give it such assistance as the agricultural societies deem necessary for its full development. Technical schools can be established in our large manufacturing cities and towns, adapted to the wants of the locality.

The farmer needs instruction in his business as well as others, but his occupation prevents that concentration of persons and property necessary to sustain such a school.

The State, therefore, must supply the need, and furnish the instruction demanded by him, by sustaining the college with no parsimonious hand, until private munificence shall come to its aid, and make it, like other colleges in the State, self-supporting.

While the facilities of communication compel our farmers in a great degree to abandon the crops cultivated by their fathers, and adopt others better suited to the present demand, and thus for a time burdening them with expense, still, in some respects, they are greatly relieved from the embarrassments of their predecessors.

The cheap and rapid transportation by railroads, which now reach almost every village of the Commonwealth, takes away any special advantages enjoyed by one agricultural community over another, and distributes widely not only employment but products. Formerly the farmer was obliged to make long and tedious journeys to find markets for his surplus products; now he can find sale for them in his own village, saving, thereby, both time and exhausting labor.

Formerly the articles in demand were few, and the competition amongst sellers very great, thus reducing the price, oftentimes to almost the cost of transportation. Now the demand is so various that almost everything that can be cultivated is readily sold, especially such things as need careful culture and attention. The crops most profitable to raise near our manufacturing villages require usually but a small

amount of land, which, when properly prepared, is easily kept in condition many years, and affords fair, if not an abundant return for the outlay.

Hitherto, the farmer has suffered greatly from competition, the result of cheap transportation to the West, where lands are more fertile and much cheaper. The influx of population there has raised the price of land in desirable localities so much that the cost of raising produce, already is partially equalized with the East; and this process will steadily go on until the Eastern farmer will be able to compete with the Western, especially in those articles requiring skill and experience in cultivation. The Eastern farmer has many advantages not possessed by the Western.

He has an excellent market at his own door, at all times, and at the highest prices to be obtained anywhere. He lives in an established community, with roads constructed, churches, school-houses, and other public buildings standing ready for his use, and adapted to his wants. He has around him the results of the labors of five or six generations, each one doing something for his comfort and happiness. He is surrounded by public institutions devoted to the diffusion of literature, science and art, founded and endowed with thoughtful care and wisdom, and daily increasing in usefulness from the benefactions of noble men, who esteem it a pleasure, as well as a duty, to contribute by their genius or their wealth to the elevation of their fellow-man. He is with kindred and early friends who are ever ready to cheer and assist him. He knows not the longing for home and fatherland, which the emigrant feels, nor the fear that poverty may overtake him in a land of strangers, destitute, necessarily, of many of the comforts which are freely offered him here.

Let young men hesitate long before they leave these beautiful homes and pleasant scenes to the possession of others, who are compelled by the unfavorable circumstances surrounding them, to emigrate from the land they love, to this land of promise, this home of the Pilgrims, made glorious by their prayers, sacrifices and labors.

UNITY OF INTERESTS.

From an Address before the Berkshire Agricultural Society.

BY ELIPHALET STONE.

Agriculture and civilization have walked the world together since the pastoral age; and although agriculture lies at the foundation of all our interests, still it never could reach its highest usefulness without the stimulus of other industries. A community of farmers, isolated from other influences, will naturally fall into a state of careless indolence and will cherish no desire beyond their most common necessities. You propose to them to introduce other interests and they will look upon it as an invasion of their rights. But this spell of apathy being once broken by the introduction of manufacturing pursuits, and the agriculturist will awake from his slothful dreams and coöperate with the general progress of things and wonder that the world moves no faster.

With industry comes economy, and when idleness steps out, energy and manhood step in.

With manufacturing industry come all the improvements of the age, better common roads, railroads and canals. Waters that have flowed for centuries untamed to the ocean, now turn the wheels of industry and furnish a highway for the better transportation of the products of the farmer and the manufacturer, creating a home-market and cheap carriage for their surplus productions.

It is then and not till then that the farmer awakes to his own interest. It is then the farmer becomes anxious to probe Nature and wrest from her her richest treasures. His calling assumes a new dignity and importance. It ceases to be a mere means of livelihood, and becomes one of the chiefest instrumentalities of wealth, influence and honor. His land rises

in value, his productions are increased, and he supplies himself not only with the necessaries of life, but with its luxuries also, and he becomes truly a lord in creation.

The farmer who produces food and the raw materials for the manufacturer, must in return receive the products of the manufacturers,—such as tools, clothing and furniture,—and the closer their interests are allied the greater the profits and the cheaper will be their products to each other.

The produce of the farm especially will not bear a long transportation, as the cost would absorb the whole profit above production. The cost of food that would feed a thousand people at home, would not feed five hundred at a distance of a hundred miles, without the ready means of steam or water transportation.

Thus it will be seen that a population combining all these interests in close relation can supply each other's wants much cheaper and to the material advantage of all, sending the surplus to a foreign market and bringing in return such articles as are not produced in the home-market, and giving to industry its greatest reward.

The capital expended in the construction of improved means of communication will generally repay the cost in the increase of the value of property situated within the range of its business. It brings the producer nearer his market, and he reaps more equal advantages with those who live nearer the cities and large manufacturing towns.

The cost of an article depends not only on the production but also on the cost of bringing it to market. Coal would be valueless at the mines unless there were other means than human power to transport it to the consumer. But with steam and railroad facilities it becomes cheap fuel thousands of miles from the mines. And the same power brings all parts of a country into close relationship. Thus all branches of industry help and assist each other, and all are made richer and happier.

But the vital utility of manufactures to the farmer is in their *subserviency* to agriculture by affording to the husbandman a nearer and steady *home-market.* They give him the advantage of two markets instead of one. And instead of quickening the industry and augmenting the resources of other

nations, they stimulate and increase the capital and honor of our own.

In order to show the more intimate connection between agriculture and its kindred interests, I would refer to a speech of Mr. Stewart of Pennsylvania in Congress on the Woollens' Bill of 1828. He said that he supported the bill from its supposed benefits to agriculture, on the ground that protection to our manufactures created a home-market for our farmers which no change in Europe could affect, and prevented the importation of foreign agricultural products to the neglect of our own. He continued: "What is the importation of cloth but the importation of agricultural products? Analyze it, resolve it into its constituent parts or elements, and what is it? Wool and labor. What produces the wool? Grass and grain. What supports labor but bread and meat? Cloth is composed of the grass and grain that feed the sheep and the bread and meat that support the laborer who converts the wool into cloth." He also controverted the idea that the encouragement of manufactures was injurious to commerce, and held it to be a sound doctrine that the prosperity of commerce would always be in proportion to the prosperity of agriculture and manufactures.

Daniel Webster once spoke of agriculture as follows: "It feeds us, to a great extent it clothes us; without it we should not have manufactures, we should not have commerce. They all stand together, like pillars in a cluster, the largest in the centre, and that largest is agriculture." Washington said: "I know of no pursuit in which more real and important service can be rendered to any country than by improving her agriculture. A skilful agriculture will constitute one of the mightiest bulwarks of which civil liberty can boast."

Did he foresee the great struggle through which his country was to pass, and through which it could not have passed triumphantly but with the assistance of this "mighty bulwark" that compelled the South to give up sooner than she would, had not starvation stared her in the face? It was the lack of bacon and corn as well as the force of our bullets that gave us the victory. It was the power we held to supply that mighty army with bread, combined with the bone and sinew of our brave farmer boys that made the North invincible.

What could we have done without our railroads? and what interest more than any other built our railroads? Agriculture and her associate interests, without which they could not be supported to-day.

Look at California. A little more than twenty short years have passed since the discovery of her gold. For ten years she poured her vast treasures into the lap of the world, and still she was poor in every qualification that makes a state great and prosperous. She was a non-producer of the great staples. She had but little agriculture, with a rich, virgin soil, and the finest climate on the continent. She had no manufactures, and consequently but little commerce. She was poor indeed with all her gold. She saw her fault and wisely went to work to correct it.

She turned her attention to agriculture and manufactures, and to-day she holds an important position among the States.

There are two periods in the history of our country worthy of note. The first was the action of England towards her colonies previous to the Revolution. She held them in such absolute subjection that beside the common domestic industry and the ordinary mechanical employments, no kind of manufacturing was allowed. In 1750 a manufactory of hats in Massachusetts drew the attention and excited the jealousy of Parliament. All colonial manufactories were declared to be common nuisances, not excepting even forges, in a country possessing in abundance every element for the manufacture of iron. In 1770 the great Chatham, alarmed by the first manufacturing attempts of New England, declared that the colonies ought not to be allowed to manufacture so much as a hob-nail.

The monopoly of manufacturing industry by the mother-country was one of the principal causes of the American Revolution.

Freed from the trammels which had been imposed upon them, and reduced consequently to their own resources for the supply of their wants, the United States found during the war that manufactures of every kind had received a remarkable impulse, and that agriculture was deriving from them such benefits that the value of the soil, as well as the wages of labor, were largely increased in spite of the ravages of war.

After the war, the manufactured products of England again found an open door, and encountering the infant manufactures of America in free competition, the latter being unable to sustain themselves, the industry which had sprung up and prospered during the war, was extinguished.

Our manufacturers were ruined. Our merchants, even those who had hoped to enrich themselves by importations, became bankrupt, and all these causes united had such a disastrous influence upon agriculture that a general depreciation of real estate followed, and failure became general among proprietors. American industry must have perished in that struggle, if the embargo, and afterwards the war of 1812, had not come to its relief. In this period, as in the war of Independence, the industrial arts received an extraordinary impulse.

Long experience has taught us that agriculture could not arrive at a high degree of prosperity without manufacturing industry.

As Jefferson said: "The prosperity of the country can only be fixed upon a solid basis where the manufacturers are placed side by side with the agriculturists."

Allow me to quote from Mr. Allen's most excellent address given before the society last year. He said: "The stimulus given to production by the late civil war, causing high prices, induced such an increase in the manufacture of agricultural machinery and implements as to more than fill the place of the million of men drawn into the ranks of the army. And the consequence was that this nation exhibited an example such as has never been seen in all history, of a people supporting a consuming army of a million in the field of war, yet not only filling the gap, but actually so increasing their domestic products as to create a larger surplus for exportation than ever before. As compared with 1860 and the years previous, these exports, except cotton only, were actually doubled during the war, and thus our agriculture not only supplied food for the masses of the people and for the army and navy, but gold for the public treasury. What a proud monument is that to the skill of our mechanics and the enterprise of our farmers. For who can say that, but for this wonderful spirit aroused and developed in agriculture, our

soldiers could not have been sustained and the war might have been a failure?"

I think I have shown you that the cultivators of the soil stand preëminent among the great industrial classes in our country, that they feed all other classes and produce all the raw material for the other interests, and constitute the main supporting element of our commerce. I have not lessened the importance of any other interest, but have shown that all stand together in harmonious relations and that no one interest can suffer without affecting the whole. I am now brought to the consideration of the

INTERESTS OF LABOR.

Wealth of itself means nothing more than the possession of something that has a market value, and not possessed by the generality of men. It is only a benefit in the highest degree or sense when its blessings are diffused among all classes. The legitimate purpose of wealth is to ameliorate the human condition as much as possible by furnishing to man means of physical comfort and enjoyment, and opening a way for his highest moral and intellectual improvement.

To be effective, capital and labor must be on good terms. There is no natural antagonism between them. The true relations of capital and labor are best maintained where there is the greatest freedom of competitive industry, and where each is sure of its reward.

If injustice comes between them, both must suffer, and in any contention labor must suffer first, as her wants are immediate. Capital can stand a longer siege. Both their interests grow out of the wants and demands of the community, and they ought not to be circumscribed unless they interfere with morality and the public good. It is to capital we owe our public and private prosperity, and labor partakes as much of its benefits as capital, and oftentimes more. It may be and sometimes is the case, owing to peculiar circumstances, as in some kinds of business during the late war, that capital, for the time being, may reap a greater reward than labor; still the day always comes when the tables are turned and labor receives more in proportion than capital. As an illustration of this principle, let us take the woollen manufac-

turing interests during the late war. Some of these interests enjoyed unprecedented prosperity. The natural effect was to turn into that channel all the available machinery of the country. The war ending suddenly, left this vast amount of machinery in full operation and consequently the supply soon exceeded the demand. Instead of stopping or turning a part into other channels, thus reducing the product to the actual demand, the manufacturer feeling his strength in the accumulated profits of the past, continued to manufacture until the surplus was thrown on to an overstocked market, and consequently prices fell, in some cases even below the cost of the raw material. The splendid fortunes made during the continuance of the war soon vanished, and hundreds of millions were thus lost to the capitalists. Fortunate was it for the country, and more especially for the laboring-classes, that the capitalists heeded not the warnings of prudence. Had they stopped manufacturing, it would have depressed all other kinds of business, and deprived the laborer of his employment, and created untold misery and suffering. But on the contrary, wages continued at war prices and still continue, notwithstanding the decline in the prices of food and clothing. It could be shown that every dollar lost by the manufacturer was paid in wages to the laborer. The laborer continued on in prosperity while the capitalist lost all. Consider the benefits the laborer and the community derived from this sacrifice of capital. It took the splendid fortunes of the past and diffused them through the community. The true interests of the country are promoted where these powerful industrial elements operate in sympathy and attract instead of repelling each other. We want no antagonism where all ought to confederate for the common good. When we foster the great productive forces which feed and clothe humanity, we bring each calling into amity and reciprocity with all the other callings. Thus the great harp of labor with its thousand strings, touched as with a master's hand, will vibrate in harmony through all the land.

Mighty are the achievements that spring from the union of capital and labor; but their noblest offspring are the homes of our people. It is these that make the chief glory of New England. Go where you will, and more especially in the

vicinity of her cities and large villages and you will find numerous rural homes owned generally by the occupants and surrounded by beautiful trees and flowers and tasteful gardens.

These are not the houses of the rich alone. A large majority belong to the middle and even the poorer classes. There is not a spot on the continent where the people are so well fed and so comfortably housed as in the "Old Bay State." There is no spot on this beautiful earth where the poorer classes are so well fed, so well clothed and so well to do in all that confers comfort and happiness upon the individual. There is no place where the laborer receives greater reward for his toil, where he can enjoy so many blessings, free as the air he breathes, as here in our own New England. Our schools are free to all; ignorance has no excuse, and the poor shall not want.

The character of a people may always be correctly judged by their surrounding, and it is these influences that have made us what we are—the most moral and the best educated, as a whole, in the world.

The spirit of our institutions being against large landed proprietors, brings the different classes more closely into communion of tastes and habits; and a correct taste once formed in a community, becomes diffused through the whole, thus elevating the whole mass.

Let the political hucksters who are prowling up and down the land, striving to create an antagonism between the laborer and his employer, turn their attention to bettering the condition of the honest poor in their home surroundings, and they would confer a real blessing on the whole community. Let them associate with others having capital: let them secure lands in healthy locations, lay out streets and ornament them with trees and shrubs and build neat and comfortable dwellings; then let them take these men by the hand and say to them, one of these homes can be yours if you will; industry, economy and sobriety will make them yours, and they will open a fountain in that man's heart that has been closed to its own interests by the ice of envy and jealousy. The cry of these agitators is, "We must elevate labor." Yes, but you must elevate the laborer first. You cannot raise the stream above the fountain.

The thermometer of manhood will indicate every degree of excellence, and when the mercury has risen above the freezing point of the lower passions into the genial warmth of a higher manhood, then and not till then will his virtues bud and blossom.

To elevate the laborer you must first create a desire in him to better his condition, then show him a plausible way to do it.

Desire is the mainspring to all endeavor, both good and evil, and when the desire of a man goes no farther than to work that he may eat and drink, there is not much chance to dignify labor. Inspire the laborer with new incentives, awaken a laudable self-esteem and he will work with a will. Assure him he may have a comfortable homestead for his family, and the motive to exertion will put the eight and ten hour system out of his mind.

The allurements of home will absorb all inclination to roam from place to place. He will discover that he has something to live for, and becomes a satisfied, loyal citizen, a sustainer of the laws that before seemed enacted for his oppression. To place before men reasonable objects of ambition and exalt their aims is praiseworthy in the sight of all men. There are but few natures so lost to the dignity of manhood that they will betray the confidence reposed in them.

The interest of agriculture is the interest of humanity. Seven-eighths of the population of the most civilized nations are engaged in it, and it mainly feeds the inhabitants of the globe, estimated at more than one thousand millions. Nevertheless, there exists a prejudice against farming. This is not all from the outside. There is a lack of confidence among the farmers themselves. They think that other interests and professions make a greater show in the world; that it is easier to get riches and honor in the workshop or counting-room than on the farm. This is erroneous; but still the influence of this impression is as injurious as though it were actually true. Therefore any measure calculated to instil a greater respect for the farmer's calling will in a measure effect a cure. What we want is to create an enthusiasm among farmers; make them feel that their calling is respectable and respected. They will thus receive a fresh impulse and inspiration.

Let our young men but imbibe this spirit and they will impart it to all with whom they come in contact. The farm is the nursery of all the professions as well as the industrial arts of the country. From the hills and valleys of New England fresh and vigorous come the strong recruits to fill the vacant places of honor, influence and power.

The heated air of the factory, workshop and counting-room is not conducive to the growth of substantial men. These only grow to perfection in the free air of our hillsides and valleys, and the nearer the soil the better the stock. We always speak of the farmer's profits comparatively. We compare his success with that of the merchant or manufacturer, and even then we do not take them generally, but individually. We take isolated cases of success. In considering the profitableness of farming we should remember that farmers nowhere live so well and spend so much money on themselves and families as in New England. In the language of another, "There are none that make the soil contribute so much to the soul and character, none who use such excellent instruments, none who have more convenient buildings, none who educate their children better, and none whose real manhood is more purely developed in all the important relations of life."

The present is a fast age, especially with us Yankees. Everybody is in a hurry to get rich, and few are willing to bide their time and patiently pursue the intermediate steps necessary to obtain this result. We all want to begin where our fathers left off. But experience teaches us that success is rarely obtained except through patient industry persistently pursued through many years. It is only time and industry that build the fabric stately and strong. It is this restlessness and impatience that cause so many failures in life.

And the farmer is no exception to this rule. But more persons succeed in agriculture in proportion to the number employed in it than in any other calling. Certain conditions are requisite to success in any business, and with these secured, prosperity is sure to follow.

One great secret of success in any business is a love of the calling. One's heart must be in it. He must have faith and confidence and then go ahead. Again, he must understand

his calling. If the farmer ploughs deep he must manure accordingly. So, too, he must be frugal, turning everything into grist. If we gather hay we must rake after, as success often depends upon the gleanings. It is the last ounce that tips the scales.

I have said that the condition of people may be correctly judged by their surroundings. This is particularly true of the farmer. Go where you will and you can tell a thrifty farmer the moment your eye rests on his grounds. Whatever a man loves to do he will generally do well, and he will do it with an earnestness that overcomes all obstacles.

On the contrary, where there is indifference nothing is done as it should be. When the farmer is earnest he is enthusiastic, and his work is a pleasure and delight, and order, neatness and happiness are the result. The man who is a farmer by accident or force of circumstances, and has no love for the calling, can never succeed. His fingers are as stiff and cold as his heart, and they will not work.

I assure you, my friends, that there is nothing that adds a more abiding charm and satisfaction to one's life and experience than the pursuit of agriculture. Go ask the gray-haired man of business, at the close of a successful career, in what part of his eventful life his mind dwells with most satisfaction and pleasure, and will he not instinctively revert to that period when perchance as a boy on his father's farm he drove his team afield and followed his plough in the furrow, swinging his scythe in the meadow and gathering in the ripened sheaves and fruits of autumn? He will tell you that often in the battle of life, amid its alternations of prosperity and adversity, the tempting vision of the home of his childhood has passed and repassed before him, as if to win him back to the innocence and freedom of his early days; how amid the conflict of life he yearned for the time when he could return to the old homestead and there pass the evening of his existence amidst the repose and beauty of nature; to renew the golden associations of his boyhood which never forsook him in his active life; to feel again the inspiration of sky and hill and valley, musical with the songs of birds and fragrant with the breath of the fields and woodlands.

We all subscribe to the truth of the lines of New England's greatest poet, when he says,—

> "Give fools their gold, and knaves their power!
> Let fortune's bubbles rise and fall;
> Who sows a field, or trains a flower,
> Or plants a tree, is more than all.
>
> "For he who blesses most is blest,
> And God and man shall own his worth,
> Who toils to leave as his bequest
> An added beauty to the earth."

Had the principles of agricultural reform and improvements been as well understood as the principles which govern our mercantile interests, and been as well applied, our New England farms would not present the barren spectacle which in some instances we now behold.

You cannot violate the laws of the soil any more than you can the laws which govern your physical system. Similar laws govern both. Nature will supply the demands of growth according to her resources, and when exhausted, must receive back the elements of which she has been robbed, or she refuses longer to yield her wonted harvest. Science enjoins upon agriculture the condition of a self-sustaining vitality. Whatever is taken from the soil by the harvest must be returned to it again, otherwise a great injury is inflicted, not only upon the farmer, but upon the whole country. It has been truly said, "To destroy the productiveness of the soil, to squander the elements of that productiveness, is to destroy the hopes of civilized humanity, and robs posterity of its birthright to a career of progress."

We are the agents in the employ of Nature to prosecute and improve her interests; and in order to do this understandingly we must be fully acquainted with her workings.

We must understand the action of light, heat, moisture and the properties of vegetable growth; how this plant-food is formed, and how, and in what manner, the plant takes up and appropriates that food to its own use; the effect of cropping upon the soil, and the condition of the soil under any circumstances; the cause of fertility; the effects of ploughing, underdraining, irrigation, &c.

There is a love of nature instinct in every living soul.

This, if rightly influenced, may conduce to the highest interests of agriculture and render it a welcome duty to "stick to the homestead." The mind is ever active, and possesses the quality of curiosity to a large extent. It must know the why and wherefore of external objects and their relations, and it receives pleasure in the effort to obtain this knowledge, and the possession but creates a desire to know more and more. New ideas and emotions excite and perpetuate the mind's activity, which is essential to our enjoyment. Nature is boundless; she is a complete laboratory; she is full of information. The sciences applicable to agriculture are the key to unlock and disclose to the inquiring mind her mysteries. My friends, the future prospects of agriculture in this country cannot be misunderstood. The rapid improvements that are being made in the machinery of the farm, show that the mind as well as muscle is actively at work; that the days of ignorant toil are fast giving way to the united efforts of the head and hand; that the prejudices which have surrounded the tillers of the soil, like mists around the mountain's summit, are being gradually dispelled through the influence of an enlightened understanding. The farmer is about to assume his rightful place at the head of our industrial pursuits. The Agricultural College and the Institute of Technology are both established on a firm foundation. Through the instrumentality of these twin institutions of our Commonwealth, the farmer and mechanic will be raised to a loftier position of dignity and influence, with an enlarged power of blessing, not only themselves, but the world.

The time is coming when the rudimentary principles of agriculture and the mechanical arts will be branches of learning to be taught in our common schools. The time is not far distant when the living language of Nature, as interpreted by geology, botany and vegetable physiology, will be like "household words" with the farmer, who will then go forth and see how the silent chemistry of nature, like a mighty architect, builds up the gorgeous fabric of the vegetable creation, alike stately, delicate and beautiful, so will the farmer's calling be ennobled and invested with the fascinations of intellectual grace and beauty.

NEW ENGLAND HOME-LIFE.

From an Address before the Housatonic Agricultural Society.

BY P. A. CHADBOURNE.

A short time since I was called upon to deliver an inaugural address, in which I endeavored to lay down the principles of the highest and best education. And I felt called upon to say, what I here repeat, that the great want of our times is not so much that we may know how to produce more, as that we may know how to rightly use what we have. Nothing is more evident than that two families with the same numbers and having the same income, get very different degrees of enjoyment out of their means. Some families will live for one-half that another family spends, and live better; have more real enjoyment from life than the other. So, as I come to this fair and see these beautiful products of the soil, these specimens of handicraft, these evidences of *production*, I ask myself this question :—Do the people know how to use to the best advantage these products of their labor? or, are these products to pass back again to the dust of the earth, having done half their work for man; having done none at all; or, perchance, having proved a curse to him? These are important questions, for all production which is not made fully subservient to human progress and human happiness, is so much labor in vain. And in my opinion, very much of the hum and toil of business is as useless as the wind that sweeps through the cordage of a ship that is fast anchored in harbor. It may be wafting other ships on their course, but for that ship, fast anchored, it wears away its cable and hastens the destruction of the whole fabric.

I propose then, to-day, to step aside from the ordinary, and perhaps the natural, course of thought on such an occasion

as this, to speak to you of the relation of agricultural and mechanical pursuits to social life—to New England Home-Life.

If there is any subject that would seem to be worn threadbare, it is agriculture, so far as it can form the staple of an address. But some subjects never become trite—are never out of date, and cannot be too often repeated. And next to the truths that feed and strengthen our higher nature, are the truths that pertain to this physical life. All that renders life more sure, more enjoyable, more perfect in all its relations and changes, never loses its interest to the thinkers of the race. The wonders of machinery, the fertility of soils, the salubrity of climate, the beauty of landscapes, the pleasures of honest industry, and the zest of rural sports, will undoubtedly furnish themes for thought until the fashion of this world shall pass away.

Whatever may be said of the wonders of mechanics, agriculture is the basis of all civilization. And civilization is the condition of the highest rational enjoyment. Perhaps it would be more proper to say that agriculture and civilization must go hand in hand, at least where laborers are free, and are able to become the owners of the soil.

It is agriculture alone that can support the dense population which the highest civilization demands; that can furnish food for the busy throngs who control the machines that civilization has harnessed to the plunging water and the expanding steam to quadruple the man-power of the world, till the machinery of England alone equals in its producing power the unaided labor of all the inhabitants of the globe.

Agriculture must furnish not only the bulk of food used by civilized nations, but much of the raw materials to be used in their manufactures. The millions of spindles and shuttles all over the world are busy to-day in transforming the products of agriculture into the varied fabrics which the comfort and taste of civilized nations demand. But it is also to be said that it is civilization alone that can so perfect agriculture as to rest upon it. Civilization climbs by a staircase of its own building. It lays one step and then mounts that as a basis from which to build another. And the great physical basis which it must first make sure of, and imbed in every step of

its upward progress, is agriculture—*the great producer* of food and raw materials. At every upward step agriculture must be raised to the greatest efficiency possible. And this can be done only by linking it to all the other great industries of the world. They are perfect only as they form a *system*. They can no more be separated than the system of the body can be separated. The extent to which we do thus link them together will measure our civilization, for civilization advances just in proportion as man avails himself of all the forces of nature, and pushes his energies into every field of productive labor and every field of thought. The whole world, physical, mental and moral, is given to man for his inheritance, and he will never reach his highest estate till he cultivates each of these fields in due proportion. To do this most successfully it has been found that within certain limits a division of labor is necessary, as in the human body, which is one, the hand and eye and ear, have each their appropriate work. Division of labor gives skill by constant practice in a single direction, and makes one man dependent upon another, which tends to peace and good fellowship in society. But when it is carried too far, it simply transforms a man into an efficient machine, and has a tendency to destroy a full development of character. There are workmen who can only make heads to pins, or the twenty-fourth part of a steel-pen. This is their work, year in and year out. There are scientific men even, who have grown scientifically small and weak in studying science, because they judged it necessary to give their whole powers to a single line of investigation. Theoretically they seemed to be right, but practically they were wrong, because they left out of sight this great truth,—that God never made a man to prosper, in the fullest sense, by the neglect of any of his powers.

Ruskin has graphically described the dwarfing influence of that division of labor which complicated machinery and the competition of modern mechanical skill too often demands.

"We have much studied and much perfected of late," he says, "the great civilized invention of a division of labor; only we give it a false name. It is not, truly speaking, the labor that is divided, but the men. Divided into mere segments of men, broken into small fragments and crumbs of

life; so that all the little piece of intelligence that is left in a man is not enough to make a pin, or a nail, but exhausts itself in making the point of a pint or the head of a nail. Now it is a good and desirable thing, truly, to make many pins in a day; but if we could only see with what crystal sand their points were polished,—sand of a human soul, much magnified before it can be discerned for what it is,—we should think there might be some loss in it also. And the great cry that rises from all our manufacturing cities, louder than their furnace-blast, is all in very deed for this,—that we manufacture everything there except men; we blanch cotton and strengthen steel and refine sugar and shape pottery; but to brighten, to strengthen, to refine or to form a single living spirit never enters into our estimate of advantages."

Fortunate it is for society that there are employments like agriculture, in which division of labor can never be pressed to such an extent as to dwarf or weaken the powers of the laborer. And more fortunate still is it, that there is one institution of social life that can be brought in, in all places and in connection with all employments, to cultivate the common manhood of the race—to develop the higher sympathies, —to present, every day, questions of different interest and of varied relations to the world, and thus counteract the isolation of the man and partial culture of his powers, which the modern division of labor is constantly demanding. This conserving institution is the family.

The family, and the home for the family, is the real unit of society. And when machinery and commerce and science have done all they can do to lighten labor and perfect it, even by division of labor, *in the model family* there will be found a practical employment of all the faculties and powers of our nature. While we are pushing our improvements in every department of thought and industry, what we want brought to perfection to correct the defects of our civilization, is the family. What Massachusetts and every other State wants, is more homes—homes for the people—homes for every family—homes surrounded with all that civilized man needs for his enjoyment; and the nearer these homes are alike in the abundance of their comforts, the better for every member of the community.

I wish this society would offer a premium for the best farmer's home. It would pay to send a committee all over the State to find it and report upon it—a home around which all the beauties of the natural landscape were improved by all the labor expended upon it—in which it should be shown that no labor had been wasted—a home in which good order, plenty, refinement and contentment reigned. Such a home Massachusetts offers to every family in her borders, unless unusual misfortune comes upon them. Her strength and her glory consists in the number of these homes. And what is the value of all this array of industry unless it can be made subservient to the comfort and improvement of the people? And their highest comfort and greatest improvement must be found in the home. Shall we be content, then, to take the choicest parts of this State—diversified by hills and streams—and disfigure them, making them absolutely hideous, as is sometimes done by the carelessness and the thoughtlessness of men?

On two pieces of land just alike, two men with the same amount of labor will reach very different results. One will have nothing to attract and delight,—every natural beauty of the place will be marred,—while on the other everything will be pleasant and attractive. A little thought in constructing the house, even if it is a very small and cheap one, placing it in the best position—a little thought in sparing trees or in planting others—a little thought in burning old rubbish or in placing it out of sight,—in a word, *thought* and *taste* to guide the hand, will give elegance and comfort without a single hour's additional labor. This care and labor that simply tend to beautify, are too often despised by farmers. They have no time, they say, for such fancy-work. But there is no work performed on the farm which pays better. The farm that has a tasteful, home-like house—adorned with fruit and shade trees, that cost but little more than the planting—such a farm at a forced sale, will bring fifty per cent. more than the same farm bare of trees, with a box for a house, and with every mark of neglect around it. It is not a question of labor or of expense, but a question of rightly applying labor to enhance the value of our own property, and of all that adjoins us. The careless, slovenly farmer not only dimin-

ishes the value of his own estate, but he diminishes the selling price of every farm in his neighborhood. I lately heard a gentleman who has passed through Southern Berkshire speak in raptures of the increasing beauty of this portion of the county. All the property in the county is worth more for the report that has gone abroad of the spirit of improvement among the people.

But some of the papers are saying that the number of our homes is to diminish—that the hill towns of New England are to be deserted, and that great estates in the West are to absorb the small ones, and the lordly owner is yet to have his laborers around him as the southern planter once had his slaves, or as the great manufacturer has his operatives. Such men have studied to poor advantage the political economy of farming, or the effects of our institutions. The farms in this country average fifty acres less than they did twenty years ago, and I venture to predict that twenty years from now the average number of acres in each farm will be much less than it is to-day. Large farms are profitable only while you can rob the land. When the time comes that you must pay back to your lands, these small farms become more profitable in proportion than large ones. The larger a manufactory, the more profitably the work can be done, as a general thing; but not so with farming when the land has to be kept good. Just in proportion as you are compelled to transport fertilizers, and as laborers are compelled to go farther to their work, do the profits of farming decrease. But, besides this, the whole tendency of this age is for every man who works on land to have land of his own. We have no law for entailing lands, and the death of every great land-owner who bought land when it was cheap, will be a signal for dividing his estates, till each farm is only sufficient for the employment and support of a single family. And the number of acres required for this will be less in proportion as you bring the manufactures nearer to the farm, so that the farmer can produce mixed crops and command a higher price for what he sells and buy at cheaper rates.

The world will not long carry products a thousand miles to have them manufactured when they might just as readily be manufactured near the place where they are needed for con-

sumption. There will be enough of commerce left in transporting articles which cannot be produced in every place. But the welfare of every community is enhanced, its wealth is increased, or if you prefer, its ability to live well is promoted by a diversity of employment. Such communities are always the most industrious, because there is some employment suited to each one, and they accumulate wealth most rapidly. If you bring men to this country who shall consume your farm-products and manufacture for you, you have so many more homes, so many more to bear the burden of taxation for the support of government and for all improvements. We say to Massachusetts then, to the people of Berkshire County, increase the number of your homes. Encourage the young men to remain who shall cultivate the soil,—encourage manufacturers who shall consume the products of the soil, that you may send away for exchange manufactured articles instead of raw material. Never lose sight of this truth, that it is labor that enriches the State; press into your service every stream of falling water, and every other natural motive-power, but do not forget that the strength of the State will be measured by the number of happy, prosperous homes within its borders.

When the invitation came to me from President Clark to speak last year at Amherst, it found me more than two thousand miles from New England, in the very heart of the Rocky Mountains, among a people who have taken a desert where sage-brush could hardly grow on the glowing alkali-sands, and by bringing the snow-waters from the mountains in a thousand channels, have filled the hillsides and valleys of Utah with abundant crops,—with fruit-trees that bend beneath their luscious loads and with multitudes of lowing herds. And after that invitation reached me, I went far south in that territory, through its settlements, and wondered at the products of human industry that met the eye on every side. The herds and orchards, the stacks of grain, the evidence of labor everywhere, are wonderful; and yet it is only twenty-five years since the Mormons first entered the Salt Lake Valley. The Indians kill and steal, the locusts destroy, and the frosts blight; but in spite of all these troubles, the thousand busy hands are more powerful, and the vines hang thick with clus-

ters, the apple-tree bends beneath its burden, and the stacks are heavy with the choicest grain. So much must be said of Mormon industry without indorsing the mode of life among them.

All this shows that we have but to eliminate from our midst the drones,—those who do not produce,—to have all that this physical life demands. The sage-brush of Utah has given place to gardens which show that it is labor that wrings from the hardest soil an abundance for the physical wants of the race, until our numbers have increased a thousand-fold. But in the midst of the plenty which I have described, the product of the wisely-directed industry of every man and woman capable of labor, there is another picture. The mountains are filled with minerals, and adventurers have gathered there from every quarter,—men who are determined to do no work, but to live by fraud,—by fighting and by cheating, and by violence in every form. Whiskey and tobacco are the substantials of their physical life,—honest food an accidental thing, —and a home an unknown thing. A rough cabin covers them in the mountains, and an unknown grave is their resting-place when the pistol or bowie-knife or whiskey has done its work. My sojourn in such a place brought New England before me in contrast with the country in which I then was, in contrast with the mountains and the plains, and in contrast with all the countries I had visited.

What has New England that the thoughts of her children should turn so fondly to her? What does she lack that she should be the best-abused spot on our continent, if not upon our globe? What does she lack that her children are so ready to scatter from the old homesteads for new homes that can never equal those which they leave behind? When we see the numbers of New Englanders in every part of the country, we wonder that there are enough left to keep the fires burning on the old hearthstones; and when we see the spots they have chosen and contrast them with the loveliness of a New England home, we wonder at the infatuation that led them away, and still holds them, even while they remember their birthplace with love and pride. Just before leaving Utah I was invited to eat a dinner of codfish and pork-scraps, because I was from New England. And when we four peo-

ple gathered around the table, we found that we were all natives of Maine. The host acknowledged that New England was the best place in the world for the comforts of life, and yet he could not be contented when he returned there. Why? Because he had that *virus* in his veins,—that, being a mere taint when it impelled him to leave home, is now the fever that rages through every vein, and will give him no rest but in places of rapid change.

> "So, when a raging fever burns,
> We change from side to side by turns;
> And 'tis a poor relief we gain
> To change the place, but not the pain."

The whiskey-drinker, whose throat has become parched with the poison, and whose veins are filled with its fire, has no taste for the clear water in which is his only hope; but he pours down larger draughts of the exciting stimulant. So it is with those who live in the midst of a changing population, —in the excitement of a new country. Some long for the quiet which they have left, which they can never again enjoy, and others rail at the stupidity of those who remain at home, when the excitement of the whole western world is open for their choosing.

We can omit for a single day the discussion of methods for raising crops and fertilizing land to inquire how the New England home can be preserved and rendered more beautiful and attractive than it is. We may go the world over and not find more beauty than the hills and valleys of New England offer, from the freshness of its magic spring to the blaze of splendor that mantles her forests with crimson and gold as autumn is ready to yield to the reign of winter. Clear skies, invigorating air, green fields and crystal springs, certainly, New England has to offer in almost every portion of it. But the hard soil of New England has rendered so much labor needful that on many a farm where taste has found no home, and where, as Whittier intimates, "they save their pork and souls with the least possible amount of salt and sanctity," the home has become repulsive to the children. They remember it kindly, it may be, but they remember the continuous labor that made them mere drudges, leaving little time for study and less for recreation. They were hardened by exposure

according to the wisdom, or rather the folly of the times, and needlessly subjected to hardships. No wonder that such farms are deserted by those born and reared on them. They seek in some other land a home which they are sure cannot be worse than that which has ground all enjoyment and almost the life out of them. We are glad to feel that much of the austerity of the New England farmer's home has passed away; but too much of it still remains. And the first thing to be done, if we would build up the New England farmer's home, is for the fathers and mothers who now rule in them to throw around them all the beauty and refinement which a cultivated taste can give, that the childhood of our children may be pleasant, so that only the restless shall willingly wander away. There is wisely implanted in man a desire to go out into the world, to settle in new places; and the scattering of New England men has been a blessing to the country. But the tendency is strong enough without our giving it strength by marring the beauties which nature has lavished upon New England, or by making the home simply a place in which to eat and sleep, when it should be the centre of every refined enjoyment.

It is claimed that New England has too severe a climate for comfort or health, and so many are driven from it who would gladly make there a permanent home. That the climate is severe we cannot deny, and the inroads of certain forms of disease have been too marked to pass unnoticed. But the very process that beautifies the earth will render it more healthful. The farmer has but begun to learn what draining will accomplish for the improvement of soils, and this same draining, removing the surface-water, is the best of all means for securing health. In fact, the statistics of consumption are found to vary as the amount of undrained lands in every town.

I think it may safely be asserted that such cultivation of the earth as shall make it most productive in the great staples of human food, and most beautiful to the eye will render it, at the same time, most healthful. Life and health are the condition of all enjoyment, so that with our abundant products we must seek for the conditions of the best physical activity and the greatest longevity. That these can be

secured in New England for the mass of men, as well as in any other portion of the world, I fully believe.

We can but look forward to the time when all the land of New England shall be subdued, except that required for forest growth—when the marshes shall be drained and every variety of soil shall have the culture best fitted to develop its capabilities—when the hill-farms, now deserted, shall have new fires re-lighted upon hearthstones around which happy families shall gather—when so much of rural happiness shall be found that they shall wonder that such places of beauty were ever neglected—when industry and intelligence shall be so common under wise laws that every home shall have the comforts of life, and none shall be found where idleness and dissipation reign because a father hoarded wealth for the destruction of his children. We look forward to the time, which we trust and believe is coming, though it tarry long, when those who are equal before the law shall approach equality in all the conditions of a happy life. If ever that time comes, it will be because the blessings of a thorough education shall be not only offered to all, as they now are, but shall be improved by all. It will be because all forms of vice and indulgence that tend to idleness and crime, shall be driven from society, and virtue and industry installed in their places. It will be because the citizens are wise enough to coöperate in business instead of working against each other, because they learn how taste and culture give the best returns for all labor expended, because every blessing which God has given is properly used and not abused. If we can never hope to reach this, we can to-day see some approach to it in Massachusetts, and in many other parts of our country. No other million of people on the face of the globe can be found, that have better conditions for all rational enjoyment than the people of Massachusetts to-day enjoy. There is no place where the same number of people represent the same number of happy homes. Is there any other place where the welfare of the young, of the poor and unfortunate, is more bountifully provided for? Is there another place where more is given for the promotion of religion and education beyond its own borders? Is there a single State in our Union, to which men who would found a college or build a church in the West, or send a missionary

to the ends of the earth, turn more readily, or with more hope of liberal benefactions, than to Massachusetts? She has a great work yet to accomplish for her people, and for the world, and while we join in the annual prayer of "God save the Commonwealth of Massachusetts," let us see to it, by our labors in all that shall promote the physical, intellectual and moral welfare of the whole people, that we make a Commonwealth worth the saving.

HOW FARMERS CAN IMPROVE THEIR PRESENT CONDITION.

From an Address before the Hoosac Valley Agricultural Society.

BY SANBORN TENNEY.

Great as have been the improvements in farming and farm-life during the last twenty years, perhaps it may with truth be said that there is still no profession in which there is greater room or greater need of improvement than in agriculture, and in the condition of those engaged in this noble work. Born and bred a farmer, and believing that farmers are or may be the true nobility of the earth, I make this statement, I trust, free from that prejudice which perhaps I might have if my whole active life had been spent within college-walls, or in any profession widely separated from that of agriculture.

But it is one thing for a man to say that there is need of improvement in this profession or in that, and quite another to point out how improvements may be made.

Agricultural societies, agricultural fairs, magazines and papers devoted to agricultural interests, carefully prepared addresses by practical farmers, as well as addresses from learned men in other professions, have done a vast deal to elevate the grand old profession of agriculture and many of those engaged in its pursuits. But it would be only foolishness to shut our eyes to the fact that much remains to be done; that many improvements still remain to be made before the farmer, the farmer's family and the farmer's fields and crops, become what they ought to be, and what, according to every true consideration of the subject, they must be. Pardon me, then, if in the brief half-hour before us I bring before you a few things with which you are all familiar, and attempt to use them to show how farmers can improve upon their present condition.

1. Farmers can vastly improve the appearance and comfort of their homes. This is a thing which farmers not only can do, but which they are bound to do by every high consideration, physical, moral and religious. Neither the farmer nor his family can ever be what he and they might be, and what they are under obligations to be, with the kind of home and home-surroundings in which many of our farmers, notwithstanding all the great advances thus far made, find themselves to-day.

The farm-house should be snug and warm for winter, and well arranged for ventilation at all seasons of the year; and it should in all cases be painted, not only as a matter of taste, but of well-directed economy. The surroundings of the farm-house and the other buildings should also be neat in all respects. It is a curious and also a lamentable fact that there is still a feeling, quite too common, that almost any kind of a house, so far as appearances and style are concerned, and almost any kind of surroundings, will do for a farmer. This feeling is a wrong one. It wrongs the farmer and it wrongs the community in which he lives. Not only should the house be trim and neat,—mind, I do not say costly,—but if there is any man anywhere that can afford a good lawn about the house and all the other buildings, with proper and well-chosen paths and roads for all necessary and desirable movements, that man is the farmer. And that farmer who recognizes this simple fact and who acts upon it, not only receives a present and constant reward in the satisfaction which he daily feels in looking upon such surroundings, but the additional money-value of his farm will be many times greater than all the outlay he makes to secure the beautiful result.

And last, but not least, by any means, farmers can add to the comfort of their homes by more carefully preserving the strength, health and beauty of their wives. He is a brute that does not love to look upon a good and beautiful woman, and he is doubly a brute that is not benefited by the sight. Naturally, our mothers, our sisters, our wives and daughters are among the most beautiful women in the world. Why do they not remain beautiful? It is not because they grow older; for he is a dull observer and wanting a properly-cultivated mind and heart who does not know that true beauty does not

necessarily depart with age. Have you not seen a woman of threescore who has borne a family of children, cared for them as only a good mother can care for them, who has stood at the head of all the interior affairs of the household, has presided with equal grace and dignity at the table and in the drawing-room, where wealth and learning have often assembled, and who is to-day, doubtless, as beautiful as ever? I have seen such a woman, and I know her well; and she, and many others such as she, show that a woman does not lose her beauty by being a wife and a mother, nor by a proper amount of responsibility, nor even by a proper amount of work with her own hands. What then is it that gives the intensely care-worn, jaded look to so many of our American women? What is it that so takes out the lines of beauty and substitutes lines which nature never intended, we may well believe, should be there? Drudgery, drudgery, drudgery I believe is the true answer. Too much work, and at improper times, and with too little recreation. Farmers, if you would add to the comfort and light of your homes, see to it that you preserve the strength and health and beauty of your wife.

All the improvements which I have thus far suggested can be made without any reduction of pecuniary income. Nay, farmers by carefully attending to these things are ultimately far better off even in a pecuniary point of view. But more than all else, by doing these things they add comfort to their homes and to their families, and make farm-life attractive to their sons and to their daughters, who, as things are now, in too many instances are even repelled by the untidiness and unthrift which so extensively prevail in farm-life from one of the noblest pursuits in which man may engage, and make their way to the city, where, though some succeed, many utterly and hopelessly fail.

2. Farmers can vastly improve upon their present condition by cutting more grass, and thus making more hay. The hay-crop is one of the most important crops in the United States. Taking the State as a whole, it is the most profitable crop raised in the State of Massachusetts. Now, we are told that the average yield of hay in this State is only a ton or a little more per acre.

Every good farmer will bear me witness that this amount is

by far too small, and that farmers would be greatly benefited if this amount could be increased without too great expense. And I now submit that this amount can be greatly increased, probably doubled, by means over which farmers have complete and absolute control. Of course all the manure from the farm-yard should be saved. But what is the fact? In many cases there is drainage from the yards, even at the present day, and so a large part of the value of the manure is washed away by the rains. When this is not the case, the manures are too often entirely exposed to wind and weather, and the riches which the farmer might gain are borne away by the passing winds. It is not enough even for farmers to save so much of their farm-yard manure as is not washed away and is not carried away by the winds, but if they would use all the means they have at hand to increase their hay-crop, they must, by the aid of cellars and sheds, save not only the entire bulk of the barn-manures, but also the full strength of these valuable fertilizers.

But it is not enough to save all the fertilizers that come from the barn. Everything from the sinks and drains from the house should be carefully saved, mixed with earth, and added to or composted with the materials from the barn. It is not too much to say, that the materials from the sinks and other sources connected with the houses, and which in many cases are now destructive to health and comfort, would, if properly utilized, not only secure greater neatness on the premises, but would add hundreds of dollars to the yearly income from the hay-fields of a single farm. The true farmer will see to it that not a particle of fertilizing material lies unused around the house or other buildings of the farm-yard, and that not a particle is washed uselessly away by the rains, or borne away by the winds.

Again, can farmers increase their hay-crop, and other crops also, by herding all their cattle and sheep at night, and thus securing a vast amount of manure that is not needed on the pasture-lands, or if needed, would be far better expended on the grounds which are to be mown? I believe this a subject to which farmers need to give far more attention. It is not necessary to drive the flocks and herds home to the farm-yard nightly, but yards and shelters may be constructed in the pas-

tures, and an hour's time of a boy, morning and evening, and the work of a team and a man now and then a day for hauling soil into the yard, would be sufficient to secure an amount of fertilizing material which would largely increase the hay-crop on every acre of the farm. It is probably safe to say that no other labor connected with the farm would yield a greater return in dollars and cents than this. And yet how often, not to say how generally, is this means of securing fertilizing materials ignored or only partially carried out.

3. Farmers can further vastly improve their present condition by converting every bog and swamp on their farms into a fruitful field, or a meadow covered with luxuriant grass; or, they can convert them into fish-ponds even more valuable than a meadow or field. It is a notorious fact, that a considerable portion of the best land for grass in the State of Massachusetts, is to-day untouched in swamps and bogs, while men are spending their time and strength on the gravelly hillsides, and getting only half a crop as a reward for their toil.

There are on farms, in many cases, bogs and swamps which are wholly untouched, and which are worth far more than all the rest of the farm. Nature during long centuries has been gathering the richest materials into these bogs and swamps, and there they are waiting the touch of the hand of intelligent labor. A cutting down of the alders and willows, and of the coarse weeds and grasses, and a judicious and thorough draining, are all that are needed to make these the best grass-lands on the farm, and in the State.

4. Farmers in many portions of our State can improve their pecuniary condition by preserving their brooks and directing into them the coldest and best springs along their course, and then holding the brooks exclusively for those gentlemen who would like to hire the right of fishing such streams. I do not propose to enlarge upon this topic; but I will say that there is no doubt that any farmer who has a clear, cold stream on his farm, can rent the right of fishing in that stream for enough to pay all his taxes, and to pay for a good daily paper, and a good agricultural magazine, besides buying his wife as handsome a silk wardrobe as she has had since the day of her marriage. And if there are ponds on the farm

they can be properly stocked with fish, and thus be made even more profitable than if the same area were land.

5. Farmers can improve their condition by exercising more care for the forests; not only in preserving the present forests, but also in planting new ones. The people of the State and of the country at large, are using the material of the forests faster than nature produces it; and therefore, every possible means should be taken lest there come a time of want in regard to wood for fuel, and in regard to the greater want of timber and of lumber. The fewest possible number of trees should be cut down; and every tree cut should be fully utilized, and a tree should be set out for every one cut down, unless the number in the forest be already as numerous as can well come to maturity. And every rod of ground that is not fit or not needed for other purposes, should be set with a tree or trees. There are to-day tens of thousands of acres in Massachusetts that are next to useless, except for a forest, and every one of these acres should be covered by all the trees it can sustain.

Above all things the farmer should preserve his forests that are upon the hilltops. They keep the soil now there from washing away, and they shelter the ground so that it gives up slowly the waters that are left there by the rains, and which so gladden the hillsides and the meadows, and the thirsty laborer and traveller when the heats and droughts of summer have come.

And here allow me to remark, that the manufacturer, no less than the agriculturist, is interested in the preservation of the forests, not only on the hilltops and on the hillsides, but everywhere. Should the present reckless destruction of forests go on, the time will come, and not long will it be in coming, when the millions of spindles and the thousands of looms that are now moved by water-power will cease their motion; or some other power than the water-wheel will move them. When forests are cut away, the soil is no longer spongy, but becomes dry and hard, evaporation increases, and except during the seasons of rains and freshets, the springs and brooks and all the former constant feeders of the river are dry.

6. Finally, when farmers are ready to put as much care and skill into their pursuits as are exercised by manufacturers

and by skilful engineers, and men engaged in large commercial enterprises, the results which they will reach will be as marvellous and as satisfactory. There is no greater mistake than to suppose that it requires only the most ordinary sort of a man to be a farmer. That a man of little mental calibre and less mental culture can work at farming, there is no doubt. And so he can work at law, at medicine, and at theology—but what a farmer! what a lawyer! what a doctor! what a theologian! He can probably do as well in one of these professions as in another. To be an intelligent and successful farmer, and to be constantly improving, is to know, or at least to desire to know, the laws of nature as they are exemplified in the solid earth, and in the soil; in the heat and in the cold; in the rain and in the sunshine; in the seasons as they come and go in their ceaseless rounds; in the tender plant, and in the sturdy tree; and to work in harmony with the laws which have been established and which are constantly upheld by the Divine Hand.

EDUCATION AND AGRICULTURE.

HINGHAM.

An Essay by Hosah G. Goodrich.

Education in its largest sense, signifying the development of all our faculties, is so nearly synonymous with civilization, that we can look at it in no other light than a beneficial one to agriculture, as well as to every other branch of human industry; in fact, they are all the products of it. But there may arise a question as to the beneficial effect of a particular kind of education on a given branch of employment. All the progress from the stone axe and hoe, and the bone spade, to the fine steel implements of our day, are the products of minds educated by the wants and needs of the race; and a comparison of these tools shows the great length of the road of improvement, and how slowly links are forged in this chain of progress.

The school, as we have it, has been no more than one small factor to produce this result; but the plough and the spade, the mower and the reaper have come, and granite rocks and soil, a rigorous climate, and improved race, an extensive country rich in resources, have produced them, and the result is education; and these means are our educators.

The early settlers of New England were from necessity cultivators of the soil; and education, except such practical knowledge as the farm gave, was confined to the school. This was of the most elementary kind, barely sufficient to answer the demand of the simplest arts and trades. But later years have largely extended the time and means given to both general and special education, and the increased demand for larger talent and better skill has been so great that the condition of things is quite reversed, and the farm suffers

the evils of a bad reputation as a paymaster, and an unpopular taskmaster.

When the farm held the monopoly, it could say to the idle men of the market-place, "Go work to-day in my field, and what is right I will pay thee;" but when trades and professions are able to say, "Educate, and I will pay you better and work you less," then there appears to be an antagonism between education and agriculture. Knowledge cannot injure a man for the farm, if you can keep him on it; but if it is the means of his leaving it, there is a loss to the farm directly: for, in general, a man of less ability will follow. When the country was new and no manufactories existed, when commerce was in its infancy and the great West was unknown, there was little to induce men from the soil. But now the forests have disappeared, the streams have been harnessed to the mill, the steam-engine has been set up, science has commenced her rule, and art is rapidly finding a home in every family. The mountains must be excavated to bring to light their hidden treasures, and commerce must be carried on to contribute to the new mode of living. To carry on these processes, the best brains and bodies must be taken from every family, and the surplus of other countries must come in to fill up the quota of labor, demanded by three millions of square miles of new lands. The farm-labor that formerly came to us from the other New England States, is now employed in our various manufacturing interests, and our own men find more lucrative employment in connection with those departments of business, than the farm can offer. It is true that increased means of education enable them better to fill these situations, and doubtless our school instruction is the means of sending many of the best men from the farm; for the boy that reads well has the key to all knowledge, and soon gets tired of working by the month, and, if he works the soil, desires to be a landholder. It is but a short time before he prefers to superintend, while others work; and, if successful, will try to get one corner of his farm on State Street, or sell it out and go into other business, or retire. The boy with the rudiments of an education is much more likely to learn a trade and excel in it. The journeyman soon becomes an owner or superintendent, and

finally, if successful, you will find him in a suburban town, where agriculture may receive some benefit from his amusement.

But we must not count all lost, and charge it to education, that leaves the farm for other occupations. The inventive genius that left the farm, sends back a machine that with a horse liberates half a dozen to study, invent and travel. The engine of the mechanic and a few tons of coal, give leisure to a hundred to find out what the earth is made of and what may be made of it. The farm can spare men for the clay-pit, if they send back a load of drain-tile. These will unlock a new storehouse of fertility, improve the climate, beautify the landscape, and bring health and happiness.

Machinery and horses take the place of men, oxen become obsolete, and old articles of machinery become curiosities. Yet who would take away the improvements and put back the men? Nothing is more evident than that our agriculture is undergoing a great change, and many indications seem to show that its importance is declining.

Population is at a stand-still or actually decreasing in remote districts, and concentrating upon the coast and near to large commercial or manufacturing towns.

The border settler in New England twenty years ago, is close to the forest now. Half-made clearings are again growing up, and log-cabins are tenantless. Hills once covered with sheep are moss-grown, and the sons of their first owners are making shoes, or working the mines of the Sierra Nevada. While we must acknowledge that something is the matter with our agriculture, it is probably not so serious as it appears, and can hardly be charged to the account of our limited means of education. Our situation will account for much of the mischief. We live where the rule is "Much labor and small profit" to him who stands next to nature. Coal and iron are close at hand. Wood and timber, suitable for some kind of manufacturing, are found in every section, and every stream turns a mill. These advantages invite the genius and activity of the people. Almost adjacent to his own, lies one of the world's few choice gardens, where lands have been free to him who would occupy them. Railroads have followed the pioneer, and travelling is easy and

freights cheap. The mechanic can make the furniture or the dress of the Illinois farmer, and yet he will receive more bread in return than his labor on his own soil will produce! Beef can be raised in more favored climates without the expense of building and labor of wintering. New England can be fed and pay the debt by skill and industry more easily than by working her reluctant soil. This exchange depends on conditions beyond the control of education; and had our efforts in that direction for the last thirty years been less, our agricultural interest would have followed in the same direction.

Deserted farms, half-made clearings, tenantless cabins on the frontier, cannot hold education responsible till war has had its due meted out. Loss in native labor must have the gain by improved methods and means accredited to it. Decrease in tillage-land is offset by better tillage nearer the consumer. Decrease in land-value of farms remote, is balanced by increased values near to the large towns. These changes are consequent upon new modes of life and new means of carrying on our industries, and the disparity against one or another section is more apparent than real. We need not fear them on the ground of too much intelligence. An educated people will meet them better than an ignorant one. Agriculture, like any other kind of industry, will be best done by the most enlightened people. Its future may be unlike the past, but can scarcely be less mportant. The fertility and cheapness of Western lands, together with the simplicity of the early settler's life, gives the maximum of products at a minimum of expense. Increased cost of lands, diminished fertility, more luxurious modes of living, higher rates of taxation in the West, will soon begin to tell in favor of the New England farmer.

Our moss-brown hills may be covered again with the forest, and our sandy plains grow up with the pine, and our agriculture concentrate on the better lands nearer the centres of populations, and still we may not suffer from the change. If nature has decreed that the Western farmer shall be keeper of the bread-room, and weigh us our loaf, we must tell him how his sitting-room shall be furnished. If our education

enables us to do this, and get the loaf we cannot raise, our agriculture can scarce be a loser.

Our education and manufactures may safely go on to the highest state we can carry them, without danger to our farming interests. They will keep pace as fast as other conditions will allow.

Every achievement of art or science will soon reach the farmer, if it can benefit him. Men who cannot read, are not generally thrifty or wealthy farmers.

Where knowledge is largely diffused, power and wealth accumulate, and where they are, the soil will be cultivated for pleasure or profit. The more extended our general education supplemented by a special one, the better shall we be able to meet the difficulties in the way of our agricultural interests.

THE COST OF A CROP OF CORN TO THE MASSACHUSETTS FARMER.

MIDDLESEX SOUTH.

An Essay by E. Lewis Sturtevant, M. D.

It cannot escape the attention of any one who examines the various statements of the cost of raising a premium crop of corn as given in the Agricultural Reports of Massachusetts, that there is no uniform method of tabulating results which will allow the real cost of the crop to be readily seen, except in isolated instances. I propose to investigate the various reports of competitors as given in the volumes of the Agriculture of Massachusetts, and from this source, supplemented with other facts, estimate the actual cost of raising a premium crop of corn in this State.

The elements which enter into the cost of raising an agricultural crop are four in number: 1. The seed. 2. The material of value withdrawn from the soil. 3. The cost of labor, including the wear and tear of implements. 4. The interest and tax-account.

1. *The seed.* The amount of corn necessary for the planting of an acre is about eight quarts. From six to ten quarts are the extremes, according to the variety of the corn, the distance at which the crop is planted, and the number of kernels in the hill.

2. *The fertility removed from the soil.* To estimate this it will be necessary to consult the analyses given us by chemists. The amount of ash or inorganic material removed by the grain is 1.47 per cent. as the mean of nine analyses. This is 0.8232 lbs. to the bushel. This fraction of a pound contains, as the mean of three analyses, 28.6 per cent. of potash and 47.08 per cent. of phosphoric acid, as the mean of four analyses. The amount of nitrogen in this grain is estimated at

two per cent., or 1.12 lbs. to the bushel by Boussingault and Payen.

These three,—potash, phosphoric acid and nitrogen, with the possibility of magnesia in a very few cases,—are the valuable elements removed with the grain. As there is a superabundant supply of the other elements used by the crop, we need not consider them in this inquiry.

In investigating the fertility removed by the cob and the fodder, it will be necessary here to determine the size of the crop. The average of eighty-six reports gives eighty-one bushels per acre. This gives 19.067 lbs. of potash, 31.3875 lbs. of phosphoric acid, and 90.72 lbs. of nitrogen removed from the acre by the grain. The proportion of the cob to the merchantable grain is about 25 per cent. As the mean of five trials in October and November, we have $28\frac{1}{2}$ per cent., and the mean of nine trials, four of which were in the winter, was about 20 per cent. The cob contains 1.4675 per cent. of ash as the mean of five trials. Of this ash 0.4564 per cent. is potash and 0.05 per cent. is phosphoric acid. I am unable to find any determination of the nitrogen. The 25 per cent., or 1,134 lbs. of cob, removes then 0.0759 lb. of potash and 0.008 lb. of phosphoric acid from one acre.

A careful analysis of the statements gives the average amount of fodder or corn-straw, grown with one crop of eighty-one bushels, as 7,204 lbs. This is the average of fourteen reports, and as it is in accordance with the result of experiments on a smaller scale, which give the proportion of straw to corn as somewhere in the relation of 80 or 90 lbs. of fodder to the bushel of grain, I think it must be substantially correct.

Two analyses of the straw give as the mean amount of ash at 4.4 per cent., of which 18.16 per cent. is potash, and 14.08 per cent. phosphoric acid. The nitrogen has been determined by Boussingault as 0.54 per cent. The crop has then removed,—

	Ash.	Potash.	Phos. Acid.	Nitrogen.
Grain, 81 bush., or 4,536 lbs., .	66.679	19.067	31.3875	90.72
Cob, 1,134 lbs., ...	16.641	0.076	0.008	?
Straw, 7,204 lbs., ...	316.976	57.562	44.630	38.90
Total, ...	400.29	76.705	76.0255	129.62

From the able discussion of Prof. Johnson on the Valuation of Manures, I am enabled to compare the manurial value of our corn-crop with that of commercial fertilizers. In the report of the Connecticut Board of Agriculture for 1868, Prof. Johnson computes the present market-cost of the commercially valuable elements of standard manures as four cents a pound for potash, 12½ cents for phosphoric acid, soluble in water, and 17 cents per pound for nitrogen. To reduce these gold prices to currency at the present time, we must increase them 15 per cent.

Dr. Nichols, in his lecture before the Board of Agriculture in 1871, reckoned the soluble phosphoric acid at 16 cents a pound and nitrogen 28 cents a pound. If we calculate the value of nitrogen from the present price of nitrate of soda, the cheapest source of supply: we have, cost of nitrate of soda, four cents gold, equal to about 4½ cents currency. The commercial article is guaranteed 94 per cent. This makes the value of the nitrogen about 29 cents a pound, as pure nitrate of soda contains 16.4 per cent. of nitrogen. In a similar way it is easy for any one to verify the cost of these chemicals by referring to the prices-current in our newspapers.

Applying Prof. Johnson's prices to our results, as it is well to be on the safe side in calculating values, we have,—

76.7 lbs. potash, at 4 cts. per lb.,	$3 06
76 lbs. phosphoric acid, at 12½ cts. per lb.,	9 54
129.6 lbs. nitrogen, at 17 cts per lb.,	22 03
Total value in gold,	$34 63
Add 15 per cent. for currency,	5 19
	$39 82

This sum of about forty dollars can be considered as the value of the manure removed in our crop. From this fact we further obtain that when seven cords of manure are applied to produce a crop of eighty-one bushels of Indian corn, about $5.60 per cord value of manure should be charged to the crop. And further, when eighty-one bushels of corn are produced from one acre of land, about forty dollars' worth of fertility is removed from that soil, without reference to the quantity of manure applied. Again, each bushel of grain removes about 28.4 cents' worth of fertility, and each ton of fodder about $4.62.

3. *The cost of labor, &c.* The labor required on the corn-crop I find as follows :—*a*, Manuring ; *b*, Ploughing ; *c*, Harrowing ; *d*, Marking and Planting ; *e*, Cultivating and Hoeing ; *f*, Harvesting ; *g*, Husking.

a. The average of eighty-six returns gives the amount of manure necessary to produce a crop of eighty-one bushels per acre as 28 loads, or seven cords. One return gives the labor of manuring with 24 loads, and planting as 40 hours' labor of man and 16 hours of horse. I shall therefore call the labor of manuring the acre as two days of man and horse. To show the difficulty of ascertaining this matter from the reports, I will state that two farmers in one society, in a statement made the same year, estimate the expense of moving a cord of manure as at 30 cents and 95 cents respectively.

I wish it to be understood here, that it is not the extra exertion applied to a crop which determines the actual cost, but the labor which is applied in the daily course of the farmer, working under the usual stimulus and not for a specified premium ; nor is the expense of working a field adjoining the barn a criterion of the cost of working another field more distant from the farm-buildings. I find by an estimate of an engineer that a man can simply move with a shovel from 15 to 18 cubic yards of loose earth a day. Another estimates the number of trips made by a one-horse cart per day,—distance of transport 2,000 feet, or about two-fifths of a mile,—at 25 loads of eight cubic feet to a load, allowing four minutes for loading and dumping each trip. It is not unreasonable to suppose then that the farmer cannot load and move and spread on an average more than $3\frac{1}{2}$ cords a day.

b. Many farmers plough twice for their corn. Two statements give one and a half days as the time occupied. As the Agricultural Report of Maine is more full on this point, I consult that and find the average of eight statements to be 14 acres in 29 days. It seems, however, if we compare the cost of ploughing, which is frequently given, with the price of labor, that the Massachusetts farmer ploughs about one day, on the average, to prepare his acre for his corn.

c. The time occupied in harrowing differs with the practice of each farmer. Some believe in reducing the land to a fine tilth, while others are content with bringing the soil level.

Perhaps half a day's labor of horse and man is as correct an assumption for the average practice as any I can make.

d. The labor of planting is stated at two days by one competitor. As the others are silent on this point, I will make an estimate of the time, by comparing the cost of planting with the wages of labor. Subtracting fifty cents from the "cost of seed and planting," in eighteen cases, between the years 1865 and 1870, I find the average cost of planting is stated at $3.09. The average rate of agricultural wages in Massachusetts, in 1866, is given at $38.94, without board, by the year. This is about $1.50 a day. Dividing the average cost of planting, $3.09, by the average value of a day's labor, $1.50, and the resulting two days corroborates the statement given.

e. Farmers differ greatly in the care given to the growing crop, and their practices vary. Some use the plough and cultivator almost entirely; many the hoe exclusively; but the majority combine the two. From thirty-nine reports made since 1860, I find the average number of "cultivations" to be 2.4, and of "hoeings" 2.3. As to the time occupied in cultivating, I find but one statement—one day for horse, man and boy, per acre. The expense of cultivating is given in one case since 1865, at $1.75 per acre. Of hoeing, the expense given, the average of three reports, since 1865, also, is $2.93. This makes the cost of cultivation a little over $5.00 per acre, or reducing to time, about three days of man and one of horse labor. The usual allowance of half a day for cultivating and one day for hoeing on the average, when multiplied by the average number as given above, gives nearly equivalent results.

f. The labor in harvesting is not given in any case, and it differs in its method. Some cut out the top-stalks, while others are content to cut the whole plant together. The labor of cutting stalks is placed at four days by one, and the same time as occupied in hoeing by two. The average would be about two and one-third days. With this digression, I proceed to the deduction of the labor, by the cost given of harvesting. Twelve reports since 1865 give as an average $8.28 an acre. Dividing this by $1.50, the average wages, and five and one-half days is the product. It would seem as if horse-labor had not been charged at its full value in these cases.

g. The cost of husking is estimated at three cents a bushel

by one, five cents by another, while a third gives four days' labor to 97 bushels of corn. This would be about six cents a bushel. As I consider these statements to refer to merchantable corn, the average is about five cents, and reduced to labor would be about 2.7 days.

4. *Interest and tax account.* It is evident that the cultivation of an acre of land by the ordinary farmer, involves the outlay of a large sum in tools, barn room, stock for manure, and a dwelling for himself. Even fences and ditches generally help that one acre, and in reckoning the cost of a crop, it is requisite to divide the whole capital of the farm by the number of acres inclosed, and charge the dividend as the value of the acre cultivated, for the interest and tax. Unless this be done, the land must be charged with rent, and rent should mean profit, which the farmer saves to himself by cultivating himself.

By the ordinary mode of procedure, the acre is supposed to receive no benefit from fencing, and the crop no benefit of the previous manures used. Guess-work has taken the place of system. A winner of a prize for raising and reporting a large and cheap crop, distrusts his own result, and will not cultivate for farm profit what he claims to be profitable, when competing for a premium. The interest and tax account with a premium acre can never be given, so that premium crops can be justly compared, until a uniform system of valuation is decided upon. A difference of valuation of ten dollars an acre, makes about a cent a bushel difference in the cost of our crop.

Let us now tabulate the results reached, and gather the hypothetical crop.

1.		Eight quarts seed-corn, at 80 cts. per bushel,	$0 20
2.		Manure removed by the crop,	39 82
3.	*a.*	Carting and spreading dung,—2 days, man and horse,*	4 50
	b.	Ploughing, one day, man and 2 horses,	3 00
	c.	Harrowing, ½ day, man and horse,	1 12
	d.	Planting, 2 days,	3 00
	e.	Cultivation, 3 days man, 1 day horse,	5 25
	f.	Harvesting, 5½ days,	8 25
	g.	Husking, 2.7 days,	4 05
4.		Interest and taxes, say	10 00
		Total cost of the acre,	$79 19

* Calling horse half value of man,—labor $1.50 per day.

To offset this cost, we have,—

81 bushels of corn.
7,204 lbs. fodder, at (average reported valuation per acre, 1871) . $26 37

Cost of corn: $52 82
Cost per bushel ($52.82÷81 bushels.=) 65.2 cents.

It will be seen that the cost of the corn per bushel depends largely on the value given to the fodder. Of late years, it seems more valued than it was in the past. The extremes of valuation I can find recorded are "cost of harvesting" on the one hand, and $60 per acre with a crop of 100 bushels of corn on the other. The average of the valuations in four reports in 1871, when larger than in any preceding year, was $26.37, as I have given above.

Valued by the nitrogen the fodder contains, it is inferior to the best hay in proportion of one to three. Valued by the manurial elements it contains, it is inferior in the proportion of one to two.

To illustrate still further, I will compare four statements made to the Middlesex South Agricultural Society in 1870 and 1871:—

S. B. Bird, Transactions 1870, p. 8.

	1 Their own "statement."		2 Valuing manures only by my system.		3 Their own "statement," fodder made uniform.		4 My idea of cost.	
Cost of Crop, . . .	$82 47	91 cts. per bu.	$80 83	88.6 cts. per bu.	$82 47	90.4 cts. per bu.	$80 83	84.4 cts. per bu.
Stover, ...	21 00		21 00		21 46		23 85	

John Johnson,* Transactions 1871, p. 26.

Cost of Crop, . . .	$82 97	50 cts. per bu.	$96 80	66 cts. per bu.	$82 97	65½ cts. per bu.	$96 80	81.8 cts. per bu.
Stover, ...	40 45		40 45		27 09		27 09	

Josiah Gibbs, Transactions 1871, p. 27.

Cost of Crop, . . .	$56 90	47.4 cts. per bu.	$75 34	72 cts. per bu.	$56 90	44 cts. per bu.	$75 34	68.6 cts. per bu.
Stover, ...	21 30		21 30		23 85		23 85	

S. N. Thomas, Transactions 1871, p. 28.

Cost of Crop, . . .	$90 40	95.3 cts. per bu.	$85 26	88 cts. per bu.	$90 40	95.5 cts. per bu.	$85 26	88.3 cts. per bu.
Stover, ...	22 74		22 74		22 57		22 57	

* Add $7.10 for interest and taxes so that the statement may be comparable with the others.

In the first column we have the result as stated by the competitors themselves, but brought into a form by which their estimates of the cost per bushel can be compared the one with the other.

In column 2, I have substituted for their own valuation of the manures, the fertility removed from the land.

In column 3, I take their own statements, but give the same market-value to the fodder.

In column 4, I give my own idea of how these statements should be compared, taking each statement of the competitor, in this case, as correct, but bringing all the statements to a uniform basis.

I would call attention here to what I consider a fact—that whether my valuation of manures is correct or not, my method will serve as a guide in getting at the *relative* cost of growing a crop of corn. The problem must be approached from the side of the corn analysis, which is quite constant, rather than from the manures, which differ in quality, expense and bulk in each man's cellar. I bespeak a careful study of my essay, as I have preferred conciseness, which I hope to have attained without obscureness.

One more point needs to be further considered. Grant that the crop removes from the soil about forty dollars' worth of fertility, can the farmer replace this fertility from his own resources, at a cheaper rate than the raw chemicals can be purchased? This will bear investigation.

While the latter is soft and disorganized, and the dung moist and yet not very watery, a cubic foot of it will weigh 56 pounds; a cord will then weigh 7,168 pounds. In the department of agriculture, report for 1862, the composition of a ton of ordinary barnyard manure is given as 8 pounds of nitrogen, 11 pounds of potash and soda, and 4 pounds of phosphoric acid. This would make the value of ordinary barnyard dung as about $8.40 a cord, very near the selling price in our district. These calculations are not supposed to be absolutely correct in any instance, for manure varies in quality on each farm; but relatively these values are correct. That is, the ratio between this valuation and the valuation of fertility removed by the crop is the same. Now when manure is selling at $8.00 a cord, the farmer is paying Prof. John-

son's valuation for his chemicals; when dung is $6.00 a cord, the value of the chemicals is three-fourths of our valuation, or about $14\frac{1}{2}$ cents per pound for nitrogen, about $3\frac{1}{2}$ cents for potash, and about $10\frac{3}{8}$ cents for phosphoric acid. In a similar manner each person can reckon the value of the salts of his fertilizer, which corresponds with the selling value of his manures. In our district, the Middlesex South, the valuation of our dung in practice approaches its value by our theory.

It will be noticed that I only discuss the *relative* values of the chemical element in the manure and in the crop. I do not enter into the question of the absolute value of barnyard manure as compared with commercial fertilizers, and I do not commit myself here to any theory of the values or action of manures. The *true* value of a fertilizer cannot be estimated by these commercial valuations, for in practice so much depends on the bulk and the circumstances of the farm. Nor can one analysis give a very just idea of the average composition of our farmyard dung, a substance which is different in each barnyard, according to its source and the practice of each farmer. I simply claim that these calculations of fertilizing elements and values *do* furnish reliable data for the comparison of competing crops, and for the obtaining the relative cost of each crop, by furnishing a tolerably constant standard for estimating the fertility of the soil. Improved practice can diminish the cost of working the land, and of harvesting a crop. It can also increase the efficacy of dung by skill in its manufacture and application; but it cannot decrease the chemical element of the crop. If then we have a standard of fertility for the soil, as I propose, a definite method of obtaining the value of our land for the interest and tax account, we have left the variables of seed, culture, labor, judgment and skill. In these the farmer can justly and profitably compete on equal terms with his neighbor with poorer or richer soil, for soil and value of land is brought to a comparable standard.

If this essay does no more than to call attention to the almost valueless methods in vogue of recording the facts which enter into the composition of a report of a premium crop, it will have fulfilled a mission. The repetition of useless statements does no good to the cause of agriculture, nor the repub-

lishing of well-known truths. It takes precision of record and statement to found a science, and when we examine the science of agriculture, we see how deficient it is. Every agricultural society should be an experimental station—no matter how few or how many facts or discoveries it makes, each one should have the precision and form which would enable it to be used in connection with other facts derived from other sources. The common facts of the farm are comparatively unknown. What is a day's labor at any kind of work? What is the effect of various kinds of food? What is the comparative value of various feeds used on our farms? What is the usual yield of a good milch cow? These and other simple questions, which should have been determined long ago, still remain practically unanswered. The constants of agriculture are yet to be given.

OUR FORESTS.

WORCESTER NORTH.

Prize Essay by L. B. Caswell, Fitchburg.

The destruction of our forests by the woodman's axe and the devouring fire is at last making itself felt in the climate, the scenery and the industries of our country. When the early settlers of America first reared their homes on these shores they found a land of grand old forests; stretching far back towards the interior of the continent was the virgin forest in all its beauty of form and color, covering mountains, hill and valley with its luxuriant growth. Here the majestic oak, the noble pine and beautiful maple flourished in their native wildness, and covered the land with "the noblest and proudest drapery that sets off the figure of our fair planet." But these forests must fall that the rich soil beneath, teeming with the elements of fertility, which had been accumulating for ages in the vast laboratory of Nature, might be made available for the production of food for our ancestors and their flocks and herds. Necessity compelled our forefathers to clear away these forests, but we, with seeming thoughtlessness, are denuding the hilltops and stripping the mountain-sides without considering the effect which such a course will have upon the future of our country.

The functions which the forests perform in the economy of Nature are vast and varied. They are the great fertilizers of the soil and modifiers of climate, while their value to us for timber and fuel cannot be estimated. In an æsthetic point of view they are not to be ignored; they give an added beauty to the landscape, an indescribable charm which nothing else in Nature can bestow. There is no other agent of Nature which is so intimately connected with the health and comfort of man, so necessary to the continued fertility of the soil, as

the forest-trees, yet we may venture to assert that no subject has been so neglected as that of the cultivation and growth of trees.

We of New England, living in that part of the land of which it is said that "there is not another equal area of the earth's surface whereon so many kinds of valuable trees grow spontaneously and rapidly," can hardly realize the want of them. But go to the treeless prairies of the West, stand amid those fertile fields, behold on every side the boundless expanse terminated only by the distant horizon, with not a tree to break the monotony; travel for days over the prairies with no cooling shade, no barrier to protect from the sweeping winds; do this and you will realize as never before the value of trees, and will thank your Heavenly Father for the groves and forests of your own New England. But our woodlands are rapidly disappearing. The forests of Maine, which in times past have furnished the principal part of the lumber consumed in the United States and the West Indies have nearly disappeared, and the rapacious lumberman seeks for fresh conquests amid the timber-lands of Canada, Michigan and Wisconsin. Many cities and towns are now obliged to depend upon places more than one thousand miles distant for their supply of timber.

Few seem to be aware to what an extent we are dependent upon the supply of wood and timber for the comforts and even necessities of civilized life. There is hardly a trade or manufacture but requires its use. Bernard Palissy says, "I have divers times thought to set down in writing the arts which shall perish when there shall be no more wood; but when I had written down a great number, I did perceive that there could be no end of my writing; and having diligently considered, I found there was not any which could be followed without wood." The houses we live in, the furniture we employ, the implements with which we work, the vehicles in which we ride, the fuel we burn; all of these are fast consuming our forests. Already 4,000,000 acres are annually disappearing to supply these various demands, while the vast extension of our railroad system, the great increase of manufactures and the mechanical arts are yearly augmenting the demand. It is estimated that the single item of repairing the

timbers of existing railroads requires the expenditure of $30,000,000 annually. More than $100,000,000 worth of sawed timber is consumed yearly, while for fuel $75,000,000 worth is burned every year, without mentioning the vast quantities used for various other purposes. While this enormous demand is constantly increasing our supply is decreasing, and it needs not the eye of the prophet to behold in the near future an exhausted supply and a denuded country, unless the people arouse themselves for the protection of this most important crop.

Trees were not made merely to furnish us fuel and timber, fruit and shade, but for the influences they have upon the soil, crops and climate. There is in the study of vegetable physiology a broad field for investigation, through the intricate labyrinths of which the diligent student of science may wander, ever finding something new to excite his thirst for knowledge. From the lowest shrub to the giant *Sequoia*, there are influences at work upon the soil beneath and the air above us, the silent workings of which we seldom notice. One of the hardest things for our people to learn is the climatic value of trees, yet history and science teach us that they are most intimately connected with the climate of all countries. The influence which the forests exert on the humidity of the earth and air, on temperature and precipitation is immense. Spread out between the sky and earth, they prevent the rays of the sun from reaching the ground and evaporating too rapidly the water which falls. The *humus*, or vegetable mould formed by the forests, is capable of absorbing almost twice its own weight of water; thus they act as a sponge, and retaining a large part of the rainfall, allow it to pass off gradually into the brooks and rivers which water the surrounding country. It is also observed by eminent investigators, that a greater amount of rain falls in wooded than in cleared districts; as the lightning-rod abstracts the electric fluid from the stormy sky, so the forest attracts to itself the rain from the clouds. They also insure the permanence and regularity of natural springs and the water-courses fed by them.

Now let us notice the changes produced by the destruction of the forest. Evaporation increases with great rapidity; the soil is no longer a sponge but a dust-heap, and the rain which falls hurries over it, carrying vast quantities of earthy

matter into the valleys below, leaving the hillsides destitute of the elements of fertility; the little streams that formerly came leaping and foaming from the wooded hillsides are now only seen for a few months in the spring and autumn, and then there is nothing left of them but dry and pebbly beds; springs are dried up, and rivers diminished in size; bleak winds sweep unresisted from the denuded hilltops, prostrating the farmer's grain and strewing the ground with his choicest fruits; precipitation becomes irregular, now deluging the country with destructive freshets, and anon blighting the farmer's crops by parching droughts.

Have we presented these changes in too strong colors? Read the history of the countries of the Old World, the theatre of man's operations for so many centuries. Compare the present condition of many of those countries with the description given by ancient historians and writers. Palestine, which the Bible cites as the most fertile land in the Universe, its mountain-tops covered with luxuriant forests where flourished the cedar of Lebanon, unrivalled in grandeur and beauty in the vegetable kingdom, its sloping hillsides teeming with the olive and vine, the rich soil watered by the rains of heaven, and the beautiful landscape of verdant height and fertile valley. This once fruitful land is now a scene of desolation, without commerce, arts or agriculture. Its mountains are barren, the cedars have disappeared, and it is now deprived of vegetation and water because her forests were destroyed.

Classic Italy, proud Spain, and beautiful France are to-day reaping the results of this thoughtless destruction of their woodlands. From the barren plateaus of the Alps, Pyrenees and Appenines, burst forth fierce torrents, spreading wild desolation in their path and laying waste the fertile fields of whole provinces. Districts that formerly contained the most fertile land and a dense population, have become almost a barren waste deserted by man.

Rivers famous in history have shrunk into brooks and even disappeared. The poet Addison refers to this fact during his travels in Italy, in one of his poems:

"Sometimes misguided by the tuneful throng,
I look for streams immortalized in song,
That lost in silence and oblivion lie,—
Dumb are their fountains and their channels dry."

The ancient river Scamander which was navigable at the commencement of the Christian era, has completely disappeared with the cedars of Mount Ida, where it took its rise. Not only in the Old World are these destructive results felt, but they are beginning to be seen in America. Prescott in his "Conquest of Mexico" says: "In the time of the Aztecs, the table-land was thickly covered with larch, oak, cypress, and other forest trees, the extraordinary dimensions of some of which, remaining to the present day, show that the curse of barrenness in later times is chargeable more on man than on nature." The Ohio River is dwindling in size because the forests of Ohio and Pennsylvania are disappearing. Our Atlantic States are also beginning to feel the effects of the too rapid destruction of their woodlands, and it is a common observation that our summers are become drier and our streams smaller. There are many streams that a century ago were capable of turning mills that can do so no longer. But if our country is exempt from the terrible calamities which inundations and droughts have brought upon some of the fairest portions of the Old World, we may ascribe it to the fact that we have not as yet bared the sources of all the streams, nor stripped the mountains entirely of their natural covering.

European countries felt the necessity of forest-planting many years ago, and the laws of almost every State of Europe more or less adequately secure the permanence of the forest. England and Scotland can boast their thousands of acres of majestic pines, larches and oaks, while the artificial forests of France, Austria and Russia rank among the most valuable government property of those countries. Germany has imported thousands of dollars' worth of seeds of the valuable redwood from California, and the young forests growing from them are the pride of that nation. She has also established special departments for forest-culture, with the schools necessary to educate the officers in their duties of cultivating and protecting trees. Spain is said to be the only European land that makes no provisions for its forests. The Spaniard's "hatred of a tree" is proverbial, and they have reduced their once fertile and beautiful country to one renowned for its extreme aridity and desolate appearance. Eminent writers

and scientific men of France and Germany have written and studied upon the forests and their influences, until the science of sylviculture is acknowledged in those countries as of the greatest importance.

The proportion of woodland required for an agricultural country, according to Rentzsch, is twenty-three per cent. for the interior and twenty per cent. near the coast. Of all the countries of Europe, not more than four or five have over twenty-three per cent. while some are reduced as low as five per cent. For the whole of Europe the proportion is but twenty-six and one-quarter per cent., while in the United States and Canada it is as high as forty-eight; but while in Europe the proportion is increasing, with us it is decreasing. If we proceed with the destruction of our timber-lands at the rate with which they have disappeared for the last eighty years, we shall in less than thirty years reduce our proportion of timber to but thirty per cent.

There are thousands of acres in New England fit for no other use than to grow wood. If the farmers of Massachusetts, and all our Eastern States would restore their rough and rocky fields and steep hillsides to forest-growth, and expend their time on half the land they are now trying to cultivate they would be far better off than they are to-day, both physically and financially. The East needs a work of restoration, and the West a new creation. Let our New England hills and mountains again be clothed with forests, and the fertile prairies of the great interior dotted with groves and woodland until they shall become still more beautiful and fruitful. Let the now barren and desolate plains of the far West be planted with trees, until the future years shall behold them covered with fruitful farms and the happy abodes of a grand civilization.

Our agricultural societies can help along this great work by offering suitable premiums for plantations of forest-trees. Many of them have done this, but more needs to be done in this direction.

Our state governments can aid, by exempting standing forests from taxation, by imposing taxes on wood felled for fuel or timber, and by offering premiums for the planting of trees. Some of our Western States have already done this, and

others are about to do so; but above all we must look to the general diffusion of knowledge among the people on this subject. The American is reluctant to invest in anything that does not yield a quick return in dollars and cents. The forces of nature act too slowly for him, and he hesitates to plant trees because he may not himself receive the benefit of them; but he who plants a tree must be actuated by higher motives than that of direct pecuniary gain.

The preservation and planting of trees is a duty that we owe to the memory of our ancestors who have left us the waving elms and wide-spreading maples of our New England homes. It is a duty that we owe to the posterity that shall come after us when we shall have passed from the stage of life. May we so perform that duty that we can truly utter that beautiful sentiment of the poet Whittier:

> "Give fools their gold, and knaves their power,
> Let fortune's bubbles rise and fall;
> Who sows a field, or trains a flower,
> Or plants a tree, is more than all.
>
> "For he who blesses most is blest;
> And God and man shall own his worth
> Who toils to leave as his bequest,
> An added beauty to the earth."

SOUTH CAROLINA PHOSPHATES.

FRANKLIN.

An Essay by R. N. OAKMAN, of Montague.

Early in March last I left this cold, frozen northern clime in the midst of a succession of the coldest days we had during an uncommonly cold winter, and in three short days was set down in fields clothed with summer verdure, and in gardens and lawns filled with flowers, and at tables supplied with fresh fruits and vegetables. The change is sudden and incomprehensible when, as it were with a single step, we go out from frosty winds and frozen ground, and visions of ice and snow, into soft and gentle breezes and midsummer fruits and flowers.

I had read much of the wonderful discovery, or, I should rather say, the discovery of the wonderful deposit of fertilizing material on the banks of the rivers about Charleston, and was anxious to see and learn more of it. I had the pleasure, at our meeting in May, of exhibiting for your inspection what I esteem a fine collection of fossils from the beds, and in compliance with your invitation I will now proceed to give you, as plainly and briefly as I may, a description of what I saw and learned of this truly wonderful deposit.

DISCOVERY.

The discovery of the great utility of this "rock" is of recent date. From the time when the banks of these rivers began to be cultivated, it had been considered an incumbrance, cropping out in some localities on the Ashley River so abundantly as to impede the plough in preparing for the cotton row, and was gathered from the fields and lawns and put in waste places or piled by the roadside, precisely as we see the stones in our hill-towns disposed of, without any apprehension

of its commercial value. The geological position of these beds, as strata, had long been known and described, but it has been only within the past few years that their extreme richness in phosphate of lime has classed them as among the most valuable mineral beds of South Carolina. More than twenty years ago our learned Professor Agassiz, attracted by the numerous fossils, named a certain locality "The fish-bed of the Charleston basin." But his attention, like that of other distinguished naturalists, seems to have been given rather to the physical characteristics than the chemical composition of these "nodules" or "conglomerates."

The immense marl deposit underlying this rock had been frequently analyzed, and was known to be comparatively rich in phosphate, yielding nine or ten per cent. The discovery of this amount of phosphate in the marl, making it equal, if not superior, to the New Jersey marls, led many to apply it freely to their lands with good results, and some, suspecting some hidden and unknown fertilizing agents in the nodules or rock itself, pounded these also and applied them freely, though with less beneficial results. This was more than thirty years ago, and at that time phosphates, artificial fertilizers and superphosphates were almost unknown in that section. In fact guanos in this country had been in use but a short time; hence the anxiety of scientific men was to develop the great masses of calcareous marls which were found in South Carolina and Georgia. Under these circumstances it is perhaps not strange that a rock, containing a very low per cent. of carbonate of lime, should have remained unknown, so far as its chemical composition was concerned, and no careful analysis of these nodules seems to have been made until August, 1867, five years ago.

During the late war Southern men of learning and ability were put to their wits' end, by reason of the blockade, to provide and manufacture various articles for which they had been dependent upon importation. Among these was nitre, which enters so largely into the manufacture of gunpowder. While searching the banks of the Ashley and Cooper Rivers, in pursuit of this material, a distinguished chemist of Georgia had his attention from time to time attracted by the novelty of the appearance of this rock, and the abundance of the fossils

found with it, and frequently and from different localities took to his laboratory specimens and laid them away for future examination, and on the tenth day of August, 1867, he was pleased to submit two specimens to a careful analysis, and discovered to his surprise that the first gave of phosphate of lime nearly 56 parts, and the second more than $55\frac{1}{2}$ parts in a hundred. Some conception of the value of this discovery may be had when it is known that an average cargo of fresh bone will yield but little better than 40 per cent., less than 50 per cent., of phosphate of lime. Consequently here was an almost inexhaustible supply of material, better than fresh bone, for the manufacture of superphosphates. After thoroughly testing his discovery by numerous analyses, he applied to Southern capitalists who could never see money in anything but growing cotton, and was refused assistance, and afterward formed a company in Philadelphia, who are engaged in mining and manufacturing the article.

HOW IT IS.

The strata containing phosphate of lime range in position in South Carolina from the early Miocene to the middle bed of the Post-pliocene formation. It was during the early Tertiary period that the greater portion of the shore-land of the Carolinas, and south by Mobile River to the western limits of Louisiana, was formed by deposition and subsequent extensive, slow and uniform elevation. The Claiborne marls and shell-sands of Alabama are the lowest beds of this series, with the more solid buhr-stone and white limestone of the Santee River. The thickness of Santee beds is between six hundred and seven hundred feet, and has been recognized as underlying the whole neighborhood of Charleston, and contains from two to nine per cent. of phosphate which, while it constitutes a rich soil, does not justify its use or transportation as a marl, the value of which is to be estimated by the lime-phosphate it contains. Above these, in the same group, occur the gray marls of the Ashley and the Cooper Rivers. These are Miocene beds, and upon them lies unconformably the Post-pliocene sands and marls, one of which embraces this phosphatic rock.

It occupies what is known as the Charleston basin, with an

average length from north to south of seventy miles and a breadth of fifty miles. It is in the nature of a deposit varying from six inches to two or three feet in thickness, and spread over this whole area of many hundred square miles, in some places appearing at the surface, but usually several feet below, and yielding from 1,000 to 1,500 tons per acre in amount. Instead of being in a bed sloping to the sea as the river falls, about six feet to the mile, it is found in "steps" of different elevations. The chief part does not consist in fossil-bones, but rather in nodules or conglomerates. These are generally rough and irregular in form, water-worn and rounded, perforated by boring-shells, cavernous and fossiliferous, though generally only casts remain, the original carbonate of lime of the shelly portions having been removed by solution, leaving only its trace or impression, as in a mould, in the phosphatic mud in which it seems to have been buried. Suppose a layer of rock, such as I have described, piled evenly on a floor twelve or eighteen inches thick like cobble-stones on a paved street, scatter among them indiscriminately bones of marine and terrestrial animals, let a soft paste of clay and sand be poured on until all the interstices are filled, cover this with a foot or more of soil, and a good idea of this wonderful bed will be formed.

WHAT IT IS.

Without doubt it is purely animal in its origin. The bones and teeth are, of course, unmistakable, and the nodules contain, as shown by abundant analyses, an average of from 57 to 67 per cent. of *true bone phosphate of lime*, and under the microscope they exhibit unmistakable characters of bone. They are easily soluble even in dilute acids, and being almost free from phosphate of iron and alumina, with a very low percentage of carbonate of lime, this material stands among manufacturers superior to any other supply in the world. The irregular, uncertain and deeply-buried deposit of "coprolites" of the London basin is the nearést known approximate to this. This, however, contains generally far less carbonate and more phosphate of lime, and is, proportionally, more valuable. The coprolites are also hard, deeply-buried, and very scattered and uncertain in their location. These bones, especially those of now extinct animals, retain in a great meas-

ure their peculiar cellular structure, but seem, in many cases, to have materially increased in compactness and weight, by a kind of internal segregation or condensation of phosphate of lime, though no trace of mineral phosphate has ever been found in them. On this account they have been sometimes considered petrifactions, but analysis shows an almost perfect absence of silex, and they contain 85 per cent. of pure bone phosphate of lime. It may be asked if these fossil bones and phosphatic rocks are purely animal in their origin, how does it occur that the bone, retaining its original form, and to some extent its size, contains a greater per cent. of phosphate of lime than it did in its fresh state? This may be easily explained by analyzing a specimen of fresh bone and comparing it with the analysis of a fossil bone. Dr. Pratt, of Charleston, the pioneer in this discovery, and from whom I have received the greatest assistance in the study of this deposit, gives the following analysis. Take the long, hard bone of an ox,—

Phosphate of lime, ...	61.24
Carbonate of lime, ...	8.60
Organic matter and water, . . .	30.16
	100.00

Remove by decomposition, putrefaction or otherwise, from this bone 28 parts of the organic matter and water, and we have,—

Phosphate of lime, ...	61.24
Carbonate of lime, ...	8.60
Organic matter and water, ...	2.16
	72.00

And out of every 72 parts of residue, 61.24 parts, equivalent to 85.05 per cent., will be pure bone phosphate of lime. Again, to test the rock, take the average of mixed bone, such as is ordinarily used in making commercial bone-dust, and we have,—

Phosphate of lime,	40.28
Carbonate of lime,	5.32
Organic matter,	30.14
Sand,	11.80
Water,	10.50
Other matter,	1.96
	100.00

Remove the organic matter and water by decomposition, and the residue will be 59.36 parts, 40.28 parts of which, or 67.87 per cent. is pure bone phosphate of lime, which agrees closely with the average composition of phosphatic rock, as it is sold by the cargo to average 65 per cent. These are chemical evidences and striking enough to convince; but the microscope reveals the truth fully and completely, for it is easy to prepare samples of this rock which, on a slide, can only be distinguished from recent bone by their color. There can be no doubt then that these phosphates are strictly of animal origin, and consist *essentially of bone.*

By what means, chemical, physical or geological have they been collected thus into these extensive and accessible depositions? How came the monsters of the sea to make this their common burial-place for so many thousand years? Estimating the area at fifty miles square, and the deposit to average one thousand tons per acre, which is the lowest made both for extent and quantity, and we have 1,600 million tons of bone that remains intact after many thousand years, to say nothing of the many millions that have been pulverized by the action of the elements and entered into the composition of the underlying marls. The imagination fails to comprehend an amount of living beings sufficient to bequeath a quantity of bone so utterly incomprehensible. I have neither the time nor the ability to discuss the geological features of this question, and, with a single suggestion from Dr. Pratt, I leave the matter to your imagination or investigation.

There was a time—very recent in geological ages—when the peninsula of Florida had no existence; but the Gulf Stream, after circling the western and northern shores of what is now the Gulf of Mexico, swept its silent and majestic

course by a shorter and more direct route to the shores of the Carolinas. What is now the Charleston basin, then not elevated above the level of the sea, with its shelving shores and warm current, offered peculiar facilities for the growth of the coral animal, which, in its thousand forms, flourished in its genial waters. Unable to live at a greater depth than sixty feet, its outward progress was limited, and it could only grow upward to the surface of the water, forming walls or living reefs, inclosing in their rear a shoal or lagoon, in which swarmed thousands of species of marine life. Into this inland sea the weaker fled for safety and the stronger for prey, and over these reefs and into this lagoon were constantly being hurled by the ocean waves the remains of the monsters of the sea. This must have also been a place of common resort for land animals and birds of many kinds, and, after all, it must have occupied many thousand years to deposit so many million tons of bone. Some time ago a company of scientific men visited Turner's Falls to examine the remarkable geological characteristics of that locality. When the learned leader was asked how old a specimen of track-bearing shale might be, he replied he could not tell *exactly*, but it was so old that a hundred thousand years either way could be of no account. So we can imagine that many hundred thousand years may have deposited even this mass of bone in this most favored locality. But the comparatively even thickness over so vast an area is in itself wonderful. This can only be accounted for by the action of water and the constantly changing beds of the rivers in this low, flat country.

MINING, MANUFACTURING AND MARKETING.

The surface rock in the vicinity of Charleston being consumed—and there seems to be no other rock but phosphatic,—it became necessary to mine for a supply. A trench is opened in the vicinity of the river by digging first through the shallow but fertile soil, then through the sand, when, three feet, more or less, below the surface is found the stratum of rock, which, being loosened by a pick, is thrown out and taken to the river in donkey-carts, or in cars, on a temporary track, to be washed of clay and sand. It is then ready, in its crude state, to go to the factory to be manipulated into

phosphate of lime, &c. These lands have been sold for about ten dollars per acre, and many thousand acres are now held by Northern capitalists and manufacturers, Mr. Bradley, of our own State, of phosphate fame, owning several thousand acres, from which he draws his supply of bone for his immense manufactory. But these dry diggings, as they are called, are, and must of necessity be attended with a great amount of manual labor, in removing the superincumbent earth, in picking and lifting and carting and washing and storing for transportation, requiring to be handled and re-handled many times, and every time adding to the cost of mining.

It was known that the river-beds were covered with this material, and the negro, having no great affection for the pick and shovel, soon took to fishing for the rock on his own hook, and with his boat and rude kind of tongs or grapnels, would, in a short time, take enough to supply his simple wants. This led to the formation of the "River and Marine Mining Company," a corporation chartered by the legislature with the exclusive right to take rock from beneath the waters of South Carolina for twenty years, giving a royalty to the State of one dollar per ton. Beginning with the negro's simple tongs this company has expended many thousand dollars in experiments, until they have in successful operation machinery worked by steam, capable of raising from the river-bed and washing several hundred tons a day. I visited the establishment on Stono River, from which I gathered most of my specimens, and which I will more particularly describe. It is situated about fifteen miles from Charleston, by a widening creek or bayou, to and from which a steam-tug, owned by the company, is constantly plying, carrying stores of coal and other supplies, and returning with the rock to the wharf to be shipped as ordered. The Stono River may be at this point a mile wide with an average depth of ten to fifteen feet. The establishment consists of four flat-boats, capable of carrying one hundred tons each, lashed side by side, and so moored as that their position may be easily changed. The first boat on the right carries the coal to supply the engines, and when exhausted will be changed to the left side to receive the rock. The second boat carries a steam-engine and machinery to operate a dredge or steam-shovel capable of scraping from the

river-bed, and depositing on the next boat, about a cubic yard of material at each dip, one-half of which will be mud, sand and clay and the other half rock, usually in small fragments, sometimes in slabs three or four feet in length. The third boat carries another steam-engine, to operate a force-pump for washing. There are two hoppers, into which alternately are deposited dredge-loads of the material, and into which is directed a large stream of water from the pumps, with a constant pressure of seventy pounds of steam. Thus the rock is rapidly worked clean, and by the operation of a brake is deposited ready for market in the next boat, as fast as two men can shovel it away. This establishment will raise and prepare for market from seventy-five to one hundred tons in ten hours, employing about fifteen hands. The rock, at the wharf, sells for seven dollars per ton, or six dollars, less the royalty. It does not take a very sharp Yankee to figure out a profit in this business. The company have in operation another like establishment in the same vicinity. They have also, on the Bull River, about forty miles from Charleston, immense machinery capable of raising several hundred tons a day. The rock under this river is continuous, or in an unbroken layer, and has to be separated or crushed before washing.

For manufacturing, the rock is first ground into what may be called bone-meal, whence, by the use of sulphuric acid and the addition of ammonia, is prepared a most excellent fertilizer.

The great market for the crude rock is in England, where, by the use of a somewhat similar substance, found in the London basin, they have learned its value. The consumption, North and South, is rapidly increasing, so it would seem there can be no lack of demand in the market. Thus has Charleston, from being an importer, suddenly become one of the greatest exporters of fertilizers in the world, and great must be its influence on the commerce and prosperity of that city and State.

MANURES.

ESSEX.

From the Report of the Committee.

Your committee regret that no entries have been made for the premiums offered by the society for the best conducted experiment in the preparation and application of manures, whether animal, vegetable or mineral; a subject of so much interest and importance to the farmer, a subject upon which so much has been written, and yet one upon which so little positive knowledge has been obtained, one where agricultural writers and theorists, doctors and chemists, manufacturers of fertilizing nostrums and their advertising agents, farmers and market-gardeners, are agreed upon no two particulars concerning their management and application.

It requires no little courage for any one to enter the arena, either as a competitor for a premium or to add to the voluminous writings already before the public, lest one should make the present confusion more confounding.

An eminent agricultural writer and theorist advocates the importance of using all manure green from the barn-yard and ploughing directly in, lest it should lose some of its fertilizing qualities by evaporation or fermentation; when immediately a dozen others take up the refrain and continue it to the echo, until any one reading our agricultural periôdicals would be led to believe that any other use of manure would be entirely destructive to the interests of the farmer, while the most progressive farmers and market-gardeners are ready to declare that such manure is unfit for present use, for the growing of the roots and vegetables most valuable in the market. Another portion, equally sanguine, advocate the importance of ploughing in manure full ten inches deep, lest some of its good qualities should escape in the air, while the most care-

fully conducted experiments on record prove the greatest value is obtained by placing it near the surface.

Some of the most eminent agricultural chemists of this country and of Europe seem to prove by experiment, and do assert, that worn-out lands may be reclaimed to fertility, at small cost, by the use of chemicals alone; and that all the fertilizing value of a large load of barn-yard manure may be chemically represented by a basket of various salts obtainable at the druggists, that may be easily carried upon one's shoulder. And yet your committee observed the effects of a formula, prescribed by Dr. J. R. Nichols, on a part of a field of potatoes in comparison with another part manured with barn manure. (For the particulars we refer to the Report of the Committee on Farms, published in the Transactions of the society this year.)

And to read many of the circulars of manufacturers of special and general fertilizers, backed up as they are by recommendations, evidently obtained by friendly or mercenary inducements, is sufficient, in many cases to make the more credulous part with their hard earnings, to secure what appears to them the panacea for impoverished fields and short crops, usually ending in disappointment.

Now, midst all this confliction of opinions and interests, what is the farmer to do, who is anxious to improve his farm, his crops and his purse? Your committee would answer by some suggestions, based upon many years' experience and observation. It is evident that the main dependence of the farmer must be upon the deposits of the barn-yard and cellar, and a judicious system of composting.

The importance of getting all he can and saving all he gets, to be used in the most economical and judicious way, cannot be too strongly urged. All animal and vegetable substances are valuable and should be carefully gathered and added to the compost-heap. Meadow-muck and some kinds of salt marsh should be dug in dry seasons, in quantities to last for several years, for the longer it has been dug the more valuable it becomes.

The barn cellar and yard, together with the hogpen should be sufficiently supplied to absorb and hold the urine from the cattle, and no more. The process of composting can be more

profitably conducted in the field where it is to be used, than in the cellar or yard, as the treading of cattle interferes with the process of fermentation in a compost-heap, and requiring less labor to manipulate when in the field.

Your committee are aware of the preponderance of authority for keeping all manures under cover away from the air, sun, rain and snow, but we venture the assertion that a compost-heap, made up of suitable materials and properly prepared, gains more than it loses by exposure to those influences.

It is better that a compost-heap should be made up in the fall, at least four feet high, and the larger the better, in a compact form, either round or square, always commencing with a layer of muck or soil, then of stable-manure, sea-kelp or some substance that will produce fermentation, such as fish offal or fish pumace, then another layer of muck; any refuse vegetable substance may be added with the muck in alternate layers with the manure until the heap is completed. The top layer should be of muck. The manure in the heap should be in proportion of one-third, or half, to the whole, according to the strength of it. Such a heap will soon be in a state of fermentation, and, like the little leaven hidden in a measure of meal, will continue its work through the winter, until the whole mass becomes manure of equal value with the portion of stable-manure first applied.

This heap would be in suitable condition to be forked over in March, and at intervals of two weeks for the second or third time, each forking over producing new fermentation, thereby adding in value to the quality. The importance of frequent forking over a compost-heap is often overlooked. It is believed that no labor performed on a farm pays better than this, and none is oftener neglected.

The henery, privy and sink-spout should all be abundantly supplied with dry earth, or meadow-muck, each having proved to be perfect deodorizers, and much valuable manure may thus be obtained.

Those farmers who are located on the borders of the ocean may derive great benefit from its resources. Kelp, rock-weed, the various mosses growing in the ocean, are all powerful fertilizers, whose value may be doubled by composting as described above.

Night-soil from our larger towns and cities, that are so abundantly supplied with running water, is generally so diluted that the teaming of it is now of doubtful expediency. However much the sanitary condition of a city and its luxury may be increased by the introduction of water and its consequent sewerage, an immense waste of fertilizing material is caused, which must eventually lessen the products of the country to an amount incalculable.

After the farmer has carefully husbanded his resources for manure and would still add to his stock of fertilizers, the refuse of glue factories, morocco-dressing establishments and lead factories may be bought at prices that can be afforded, besides stable and hog manure, when competition does not run too high. Wet or damaged salt, as a special manure for certain crops, will sometimes double the product at very small cost. Peruvian guano, at its present price, may probably be used at greater profit than any other of the commercial fertilizers.

Bones, when reduced by the farmer himself, are valuable and may doubtless be used with profit, but no farmer can afford to pay thirty or forty dollars per ton above the cost of the bones, for grinding or reducing them to phosphate of lime and run the risk of adulteration. Your committee would especially caution their brother farmers against the purchase of the numberless so-called phosphates, that are thrown upon the market, or of guanos, whose only real recommendation is that they contain *some* Peruvian guano, or of the special fertilizers so persistently urged upon the farmer, except by using the greatest care to guard against deception.

BENJAMIN P. WARE, *for the Committee.*

FARMS.

ESSEX.

Statement of Mr. Francis H. Appleton.

My farm consists of one hundred and sixty-two acres, forty-four acres being cultivatable, and the remainder wood, pasture, marsh and waste land, which latter includes the land on which my buildings, &c., stand.

The larger part of it, including all the land which I call cultivatable, I bought March 17, 1869, the remaining part I have purchased within the past year.

When I bought the farm, the forty-four acres which I mentioned were in an almost worthless condition for farming purposes; twenty-nine acres of it were mostly covered with tough moss and old corn-hills, with a growth of young pine starting upon it, and useless, broken-down stone walls crossing it, many of which have been removed; the greater part of these twenty-nine acres had not been ploughed for upwards of seventy years; the remaining fifteen acres had, here and there, old oak-stumps and the like, from each of which a thriving growth of bushes was springing up; also numerous heaps of stones scattered about, and a portion of it was dotted over with the stumps of cherry-trees, and crossed by tumbling-down old fences. The first year after taking possession, I left the better-looking portion of these fifteen acres to cut for hay, and ploughed up and planted as much of the remainder as I thought I could manure.

This first year I planted two acres of roots, one of oats to cut green, a little corn-fodder and half an acre of kitchen-garden, and could secure only a scanty amount of manure for them, and harvested five tons of hay, mostly composed of white-weed. This was the yield of the farm in 1869.

This present year the same forty-four acres of cultivatable land has yielded as follows :—

One-fourth acre ruta-bagas yielded 2 tons 75 pounds.

One-fourth acre mangolds yielded 10 tons 1,581 pounds.

Three-fourths acre carrots yielded 9 tons 1,635 pounds ; estimated forty per cent. rotten.

Two acres winter-rye for fodder, mostly cut green, yielded also 1,300 pounds straw and 8 bushels 47 pounds rye.

One and one-fourth acres corn-fodder, cut one acre green and cured 3 tons 340 pounds (dried).

One acre onions yielded 243 bushels marketable, 18 bush els small; and where onions were killed, sowed ruta-bagas, which yielded 2 tons 1,086 pounds; estimated that five per cent. onions were rotten and a large per cent. killed by hail and cut-worm.

Four and one-fourth acres potatoes yielded 617 bushels; estimated thirty-three per cent. rotten.

One-half acre kitchen-garden; a late crop of 1½ tons small turnips.

One-fourth acre nursery of a variety of young trees imported from England.

Six and one-half acres mossy field, not yet ploughed, but to be turned up this autumn.

One-fourth acre occupied by stone walls.

One acre Hungarian grass yielded 3 tons.

Twenty-five and three-fourths acres grass-land yielded 49 tons 1,320 pounds, much of which had been scantily manured and seeded with white-clover and redtop, intending it for pasture, but all of which had been seeded down by myself.

There are also a few apple-trees in good bearing condition about the buildings, and I have also set out some young trees in the same locality. A number of ornamental trees have also been set out.

The land where mangolds, carrots and onions were sown was in each case divided into quarters and fertilized with the following chemicals in addition to barn-yard manure, but either the remarkable season, the rot, or the cut-worm have prevented my experiment from being useful, and I only give the chemicals applied :—

One-fourth without any fertilizer, one-fourth with one hun-

dred pounds phosphatic blood-guano, one-fourth with one hundred pounds muriate of potash, one-fourth with one hundred pounds phosphatic blood-guano, and one hundred pounds muriate of potash.

A part of my potato-piece, being exhausted land, ploughed last autumn for the first time for many years, I dressed as follows :—

Spread at the rate of five casks of lime per acre in the autumn, and in the spring four hundred pounds phosphatic blood-guano, three hundred pounds muriate of potash, and two hundred pounds of nitrate of soda. I have not the figures at hand to tell the exact amount of land thus treated, but it is sufficient to say that I also measured another portion of land of the same character, which was manured with barn-yard manure in the hill, and ascertained the amount of the crop on each piece. The land with chemical manure yielded thirty-five bushels. The land with barn-yard manure yielded ninety-seven bushels. The potatoes were much injured by rot, estimated loss being thirty-three per cent.

The fodder-corn was sown on exhausted grass-land, quite gravelly, and manured in the hill with barn-yard manure. Some of it reached a height of eleven feet in nine weeks from the time of seeding.

The carrot-crop should be spoken of. Your committee will remember the fine appearance of my carrots when they saw them. Not long after that time a blight struck the tops and blackened many of them, and later, in examining the roots, I found them rotting fast, and that in places only the hole where the carrot had grown and rotted entirely away could be found. In ploughing the ground after the crop had been removed, it was surprising also to see how many rotting roots were necessarily left in the ground. I judge forty per cent. to be a fair estimate of the loss.

The onion-crop, which looked finely early in the season and which had been greatly injured by the cut-worm, was slightly injured by the rot shortly before being pulled and also somewhat after pulling. Where the cut-worm destroyed the onions, ruta-bagas were planted.

The one hundred and eighteen acres of wood, marsh, pasture and waste land are capable of much improvement, which

can be brought about by light expense, with time and patience to help me.

I am at present making considerable improvement on the highway which runs through the farm, by grading and filling and building new walls, which will advance the appearance and usefulness of the road. The majority of my farm-fences are of the ordinary kinds; but I have found a thousand or more feet of portable wooden fence very useful.

The only sound building that I found upon the farm was the house, the other buildings being very dilapidated. Some of these have been repaired, others have been torn down, and some new buildings have been erected. A dilapidated barn, fifty-five feet long by thirty-seven feet wide, I have entirely renovated, clapboarded and shingled, and have lengthened by an addition to its front, thirty feet long and forty-three feet wide, so that it covers two commodious horse-stalls, one large box-stall, twelve tie-ups for cows, one bull-pen, ample carriage-room, a boiler and grain room, hay-scales immediately inside of large barn-door, and storage-room for about forty tons of hay. This year, by filling up much of the driveway from the floor to near the gable, I have made more storage-room. I shall probably lengthen my barn forty-five feet during the coming half-year. My buildings are painted, except the hospital and henery, which are washed with a color to correspond. All the buildings have been built simply, but strongly, with reference to use and with no other ornamentation than to give their exterior a neat and tasteful appearance without incurring unnecessary expense, and many of them have been built by myself.

The approaches to my buildings and to my barn-yard have been much improved by grading and filling; but it is impossible to describe in a short space on paper how poor a condition I found them in.

My Ayrshire herd consists of an imported bull, three cows, two heifers and two bull-calves. I have taken great care in selecting those of my animals that I have not raised.

They are only those which either have been imported, those whose immediate ancestors have been imported, or whose ancestors' pedigrees can be traced back to their progenitors in Scotland. My Ayrshires are mostly young stock, and include

an imported bull and a heifer, Lady Essex, 1,413, which has just dropped a fine bull-calf, and which is a promising milker. I have also five grade cows, four of which I bought last spring.

Having kept an accurate account of the doings of my cows, I can give the following statement of their yield in pounds, &c.

The age given is taken on July 1, 1872; the weights are those recorded March 23, 1872, and the number of days in milk are comprised between August 26, 1871, and August 25, 1872, inclusive.

NAME.	Age.	Weight of Cow, Pounds.	Number of Days in Milk.	Weight of Milk, Pounds.
Maud, 604, ...	8	1,268	320	8,159$\frac{3}{4}$
Lily Dale, 1,475, ...	4	975	283	7,728$\frac{3}{4}$
Lassie, 1,442, ...	4	1,151	290	5,277$\frac{1}{4}$

My milk is at present all sold to a milkman at the barn.

I have five half-Chester and half-Suffolk pigs, three months old when your committee saw them, bred by Henry Saltonstall, Esq., West Peabody, Mass.; also two farm-horses.

My implements are at present a No. 4 Clipper Mower, a Bullard Hay-Tedder, and other necessary haying-implements; a Holbrook's two-horse Swivel, which does almost all my work, an Eagle 20, and other ploughs; a Hinge-Harrow, Shares', Thomas' Smoothing, and the ordinary Brush-Harrow; a large, two-horse, cast-iron Roller, made in sections, and other necessary wagons, tools, &c.

I have also a collection of carpenters' tools, which have enabled me to erect several necessary buildings upon the farm. I propose to build an addition of forty-five feet in length in the rear of my barn during the coming winter, and do as much of it as possible upon the farm.

Since writing the foregoing, after having visited many of the most noted Ayrshire herds, I bought two heifers in milk, whose blood seemed to be most remarkable for its milking properties.

RECLAIMING SWAMP-LANDS.

MIDDLESEX SOUTH.

Statement of Peter Fay.

The land which I enter for premium was purchased by me in October, 1867, containing five and one-half acres, for which I paid five hundred dollars. It lies near the centre of the town. It had been used generally by the former owner as mowing-land. In the centre of it about two acres was a wet meadow; some portions of the remainder were very rocky, with hard-pan, cold and springy; and there were portions not worth mowing. All it was worth for agricultural purposes, in the condition it was in when I bought it, was fifty dollars per acre. In the year 1868 I commenced draining, and succeeded in draining the water about two feet from the surface, which I consider is sufficient for any meadow. In the fall of 1868 I commenced digging and blasting the rocks on the upland, one acre of which was very rocky, many of the bowlders being two and three feet above the surface. I piled them up and drew them off in the winter following. In the year 1869 I finished digging out the rocks where I could not till the first crop of rocks had been removed. I then filled up the large holes with the small rocks to within about eight inches of the top, and left every rock in the ground that would not interfere with the mowing-machine—the rocks in the ground being a great benefit, if the land is to be kept for mowing, as they give heat, moisture and richness to the soil. After finishing the digging of rocks I commenced laying underdrains (in the hard-pan soil) from two and one-half to three feet in depth, and about the same in width. All the drains were laid with stone; the sluice for the water to pass off was about six inches square; the ditches were then filled with stone to within eight inches of the surface, the remainder

being filled with dirt. I then carted on to this ground where the rocks were taken out, and on the springy land that I had drained, about two hundred and fifty ox-cart loads of good loam, which I obtained by re-setting a wall which was near at hand—the land being about two acres. I then carted one hundred and forty horse-loads taken from the barn-cellar, which had been made the winter previous from horse, cows and swine, never allowing the loss of any liquid, or the manure to burn. The manure was soon spread after carting out; then one-half a bushel of herdsgrass seed and one peck of redtop was sown to the acre; the ground was bushed with a heavy bush and rolled with a loaded roller.

The first of April following I sowed twelve pounds of clover-seed to the acre, on top of a light fall of snow. The seed sowed in September took finely; the first crop was cut the last of June, it being very much lodged, and was then just coming into blossom. Three and one-half acres yielded thirteen good horse-loads. The second crop was cut the last week in August, producing five horse-loads of rowen. July and August were very dry. This was in the summer of 1870. The first crop was not impaired by the drought—the second was, although I had a heavy growth of aftermath after cutting the second crop.

In the month of August, 1870, I ploughed the one and one-half acres lying in the centre of the five acres (it being well settled and drained), borrowing for the purpose a sharp plough made for ploughing meadows, cutting a furrow about fifteen inches wide and nine inches in depth, turning it over flat. It took four large oxen to plough it. The soil is a very old deposit; from two to three feet of the top is fine and black, then gradually turning till you get to the depth of eight feet, then it is a light ash color. I think the deposit to be very rich. After ploughing it I rolled it with a heavy roller; then was carted on to this one and one-half acres one hundred and ten horse-loads of manure from the barn-cellar; this was spread, and I sowed on the same three pecks of herdsgrass seed and one peck of redtop; it was then harrowed with a horse-harrow, then bushed and rolled with a heavy roller. The seed came up well, although the fall was dry, the light rains being sufficient to moisten the top of the

ground. The clover-seed was sown in the spring. The herdsgrass was very large, averaging about three feet in height; there was no clover to be seen on this piece of land the first crop. On this one and one-half acres there were seven horse-loads of hay, and on the whole five acres there were twenty horse-loads the first crop and five the second; the summer of 1871 was very dry.

As an experiment, I took four square rods of the meadow and carted on sand and gravel, which cost me one dollar per square rod, having to cart it about fifty rods; it was manured the same in quantity as it was where I ploughed it; it was spread, rolled and bushed; where it was ploughed and all prepared for the seed it cost thirty cents per square rod, seventy cents per rod in favor of ploughing. The crop of hay was about the same.

In the year 1872 the five acres, the first mowing, which was done the first of July, produced twenty horse-loads; the second twelve, mowed the first of September, and the third crop is now quite large, to be left on the ground for winter protection.

There is some of the best land in Massachusetts which lies profitless for the want of draining and clearing of stone. But one thing must be more fully understood by farmers of this State; that no farming, or gardening, or fruit-raising can be carried on to any profit without manure. And here let me say that in my opinion more than half of the farming in this State is on the reducing system; and one of the greatest mistakes, so far as my observation goes, is, after the farmer has reclaimed his meadow of swamp-land, he thinks he has nothing more to do with it but to secure the crop, and after mowing it five or six years "it runs out," as we call it, and then he exclaims against reclaimed meadow and swamp-land, when if he had given it a good top-dressing every other year, he could have secured two good crops a year, making four crops to one top-dressing of manure, and that ought to satisfy every reasonable man. The main crop for the farmer of Massachusetts to raise is not corn, nor oats, barley, wheat or rye, but hay, *hay!* and that is to be raised, not on our dry fields, but on our moist lands.

The following is the expenditure upon the land from 1868 to 1872 :—

Expended upon the land in the year 1868, . .	$185 68
" " " 1869, . .	167 42
" " " 1870, . .	112 30
" " " 1871, . .	12 35
" " " 1872, . .	14 00
The first cost of the land, ...	500 00
	$991 75
Hay and rowen on the three and one-half acres in the year 1870, 9 tons 3 hundred, at $25 per ton, .	228 75
In the year 1871, 13 tons 10 hundred, at $30 per ton,	405 00
In the year 1871, 10 tons, at $40 per ton, . .	400 00
	$1,033 75

In the three years there were 375 horse-cart loads of manure spread upon the land, valued at, ...	$375 00	
Cost of getting out the manure and spreading, for three years, . . .	73 00	
Interest on the land and taxes for 3 years,	204 00	
Cost of gathering crops for 3 years, .	190 00	
		842 00
Profits for three years, ...		$191 75

PETER FAY.

SOUTHBOROUGH, Nov. 1, 1872.

HAMPDEN.

Statement of J. D. Taylor.

HIRAM FOWLER'S SWAMP.—This swamp lies about a mile south of Westfield village, and is known as the "Hundred-Acre Swamp." It is surrounded by a high hill, except on the north, and from the base of the hill issue numerous springs of water. The soil is in places peat, twelve to fifteen feet deep, and fit to burn, and in others thin, wet, sandy loam. I came from Minnesota to take charge of Mr. Fowler's farm in April, 1871, and after careful examination of the swamp,

concluded that its growths could be changed in four or five years from brush, skunk's-cabbage and water-grass to Timothy and redtop, and be made to yield one and one-half to two tons of good hay per acre. Draining was the first step, and we commenced by lowering the main brook some three feet at the foot of the swamp, for this purpose going down from the swamp some two hundred and fifty rods. The ditch was continued at the same depth some sixty rods across the north side of the swamp, which so drained about six acres that ploughing was undertaken. For this purpose a large cast-steel Minnesota prairie plough was used, drawn by two yoke of oxen. It was late in the fall when the plough arrived, and hence only about two and one-half acres of the dryest portion was ploughed. This ground after being harrowed was sown to Timothy, redtop and clover, but so late that the grass-seed did not come up till spring. This ground yielded about a ton and a half of good hay per acre. A part of the swamp is grown up to alders, birches and maples, the largest of them about six inches through. Last winter four or five acres of wood were cut off, and last August about two acres were cleared and dragged with a stout, three-cornered harrow and sown with the usual grass-seeds. To-day (November 12) it is covered with a nice mat of grass, some four inches high. My plan is to serve all the wooded portion in the same way, and after stocking with grass-seed, pasturing it close for three or four years, until the stumps are rotten, when it can be ploughed with the big plough. We shall use both tiles and open ditches in future draining, and so practically test the merits of each.

J. D. Taylor.

Westfield, Nov. 1872.

DESTRUCTION OF CANKER-WORMS.

ESSEX.

From the Report of the Committee.

The society offers two classes of premiums,—one "for the best-conducted experiment in preventing the ravages of the canker-worm," and one for "a new, cheap and effectual remedy against the ravages of the canker-worm."

For the first-named premium there were two entries,—one by Mr. Thomas Sawyer, of Boxford, and one by Mr. Charles K. Lake, of Topsfield. The committee visited the orchards of both competitors in the first part of July, when the extent to which the orchards had been eaten could be easily seen. Mr. Lake entered two orchards which had been mainly protected by Ordway's Protector, of which further mention will be made. Although no statement has been submitted by Mr. Lake, and although he was suddenly called from home just before the committee visited his orchards, so that they were unfortunately deprived of his valuable personal explanations, yet the committee by inquiry of others were able to arrive at what seemed to them a satisfactory conclusion.

The protector chiefly used by Mr. Sawyer is simply a trough or gutter laid upon the ground around the tree and filled with coal-tar from the gas-works. His statement, which is herewith submitted, gives a very clear account of the course of experiment which has led him to adopt this remedy. Many of his trees were almost entirely free from signs of the canker-worm, certainly perfectly protected from practical injury to the fruit. Your committee recommend that he be awarded the first premium of twenty-five dollars.

There were two entries for the hundred-dollar premium,—one by Mr. Sawyer and one by Mr. Thomas K. Leach, of Topsfield. Your committee regarded both entries as substantially for the same thing. Mr. Sawyer uses a trough or gutter

having a rectangular channel, while Mr. Leach cuts out a triangular channel, thereby wasting less stock, presenting a wider surface of tar and yet requiring less to fill the trough. Mr. Leach has manifestly made an improvement in the construction of the trough, but as troughs somewhat similar to those are said to have been used in the town of Danvers many years ago, your committee think neither of the above-named gentlemen entitled to the premium for a "*new*, cheap and effectual remedy for the ravages of the canker-worm."

They recommend, however, that in consideration of the value the introduction of these troughs is likely to be to the public, a gratuity of fifteen dollars be awarded to Mr. Leach for his improvement in their construction.

Perhaps it should here be stated that one member of the committee dissents, for reasons which he has embodied in the accompanying minority report. We understand that he objects to giving any premium whatever, because he believes that the destruction of the canker-worm will be accomplished soonest by letting it alone. But assuming the policy of offering these premiums to be sound, he would agree with the majority in respect to the proposed awards. We have here neither time nor space to discuss his view of the subject, but for the benefit of those orchardists who do not accept his theory and are determined to fight the canker-worm, we wish to present the facts brought to the notice of the committee, and the conclusions drawn by the majority in reference to the different methods of opposing the canker-worm now in use.

The troughs used by Mr. Sawyer are made of two-by-three joists sawn from two-inch plank. A channel an inch or more deep and an inch and a half wide is grooved out and the stock is then sawn off in a mitre-box at suitable lengths for different sized trees, and the pieces nailed together, one side slightly, so that it can easily be removed when placed around the tree. A square box or trough is thus made which is laid level on the ground around the tree. The space between trough and tree-trunk is filled with dirt, the trough itself filled with coal-tar from the gas-works, and the work is done. On ploughed land it is easy to level up the earth around the tree, but on grass-ground it may be necessary to carry sand or dirt on

which to place the trough. The troughs first used by Mr. Sawyer had a cover of boards to prevent the rain and leaves from getting into the tar. But he finds the plain troughs just as effective at less than half the expense, although of course they require a little more care. He states that he made his troughs himself, and that they cost from twelve to seventeen cents per tree. Of course they can be made from the cheapest, coarsest plank, and after they are laid down the tar will help to preserve them many years. The cost of the coal-tar is said to be small.

Mr. Sawyer states that he found it necessary to stir the tar but two or three times in the spring or fall, and that few troughs required refilling. At the time of holding the annual fair in Gloucester, he told us that by stirring the tar then in the troughs many of them would effectually bar the passage of the grub. These statements seem to show that the trees will require but little labor or expense for several years after the troughs are put down. We have also made inquiry of other parties who have used these troughs, and the testimony is unanimous as to their effectiveness when properly used.

The troughs used by Mr. Leach differ from those of Mr. Sawyer only in having a triangular channel, which Mr. Sawyer admits to be an improvement. Mr. Leach thinks his troughs can be furnished ready for the trees at twenty-five cents each, as orchards average. Of course the expense will largely depend on the quality of the lumber used.

Ordway's Protector is an ingenious metal contrivance encircling the tree, and suspended from it by a cloth, and presenting sharp edges over which it is claimed the grub cannot pass. It was patented some years ago and is quite expensive. The design being simply to prevent the ascent of the grub, it has been found that the grub, finding no way of climbing the tree, lays her eggs on the cloth by which the protector is suspended and on the trunk of the tree below. As soon as the young worms are hatched they ascend the tree and climb over the protector. To overcome this difficulty Mr. Lake covered the trunk of the tree below the protector with cloth, so that after the grubs had laid their eggs, it could be removed and the eggs destroyed with the cloth. The result of his experiment showed that the protector thus used was quite successful,

although the committee thought the trees were damaged about as much as the average of trees protected by other methods. Perhaps Ordway's Protector is as effectual a preventive as anything which does not cause the death of the grub before laying her eggs. Mr. Sawyer states that by tarring the trees above the protectors, he became satisfied that the grubs could could not pass over it, but he also states that he caught grubs and young worms ascending the tree at the same time. He also found large numbers of young worms hatched upon the stone walls by the side of the trees, from which it is fair to presume that they would travel to the tree.

If it is a fact that the grubs lay their eggs upon the stone walls and stubble and continue to run until after the young worms begin to hatch, it seems to be clearly demonstrated that no protector can effectually save the tree unless it causes the death of the grub or prevents the ascent of the newly-hatched worms. The expense, and the fact that a new cloth for both tree and protector must be annually supplied, constitute the principal additional objections to a general use of Ordway's Protector.

There was also brought to the notice of the committee, by Mr. John Bradstreet, of Wenham, a zinc protector, consisting of a trough surrounding the tree and designed to be filled with kerosene oil. This costs twelve cents per inch (in diameter), and was patented in 1865. We were unable to pronounce upon the effectiveness of this protector; the only objection raised was that of expense. Another contrivance brought to the notice of the committee has been patented, we understand, by Mr. Mears, of Essex. This consists of a trough or gutter of coarse cloth or bagging. A hoop is sewn into a cloth, the upper end of which is tied tightly around the tree, and by raising the hoop a gutter is formed which is to be filled with tar.

The tar weeps slowly through the cloth, constantly presenting a surface of fresh tar underneath over which the grub cannot pass. And if the grub is able to pass over the underside she still has to cross the tar in the trough. We did not hear that this remedy had been tried sufficiently to test its value, but if not too expensive it may prove a useful preventive against the ravages of the canker-worm.

The application of tar or printers' ink to the trunk of the tree, with or without tarred paper, is probably the most common method of preventing the ascent of the grub. It is generally believed that ink is better than tar, because it requires less frequent applications, still there is a wide difference in the estimates of its value by those who have used it.

Mr. Sawyer states that in his case ink was too expensive, and yet the writer of this has used ink on an orchard of ten or twelve hundred trees for the last four years, and has protected them from substantial injury to the fruit at an expense probably less than would have been required by any other known method. These apparently conflicting statements can doubtless be reconciled on the theory of difference in location. It is well known that the grub begins to run as soon as the ground is thawed after a severe freeze, and continues to run whenever the weather is warm enough through the winter and spring until the season is over. The warmer and dryer the location the sooner and oftener will the grub make her appearance, and consequently an orchard situated on a southerly exposure, on warm land, will require very much more attention than one on a cold, wet soil exposed to the north. Mr. Sawyer's orchard is situated on warm, dry land, while mine is on a colder soil, inclined to the north, and hence there is no doubt that it would require much more labor and expense to protect his orchard equally with mine by this method of using tar or ink.

The chief objection to the use of tar or ink is the uncertainty of accomplishing the desired end. The grubs will sometimes run when least expected, or a storm will set in and prevent renewal of the tar or ink, while it nowise hinders the grub. Sometimes, too, in inking a large orchard, the workmen become careless and occasionally miss a tree, or make an imperfect application of the ink, so that the grubs can pass, and one omission of this kind is fatal when the grubs run thickly.

If the ground shuts up early in the fall, and remains frozen till late in the spring, the trees can be pretty effectually protected by a careful application of ink for from two to four weeks. But it is extremely difficult in our open winters and early springs to do more by this method than to repel the main army of grubs from our orchards.

These methods of preventing the ravages of the canker-worm are all that have been brought to the notice of the committee. Any of them properly used will doubtless prevent serious loss in the crop of apples, but the farmer desires to use that method which best combines economy and effectiveness. None of them will prove satisfactory without the utmost care in their application, for the grub is a most persistent and determined creature and only succumbs to impossibilities. But it is also true, that the more thoroughly the trees are protected the less the attention afterwards required.

The first year that tar, ink or any substance which kills the grub is used, there is constant danger that they will appear in such numbers as to "bridge over," and thus enable some to cross on the dead bodies of their comrades. But after an orchard has been well protected, there is little danger that the grubs will next year go up in sufficient numbers to do this.

It is evident enough that every orchardist can protect himself from serious injury by the canker-worm if he chooses to make the effort. Let him invest sparingly, if at all, in new-fangled notions and patents, but adopt those methods which have been tried and found successful, and which do not require large outlay. Let him remember that "Eternal vigilance is the price of *fruit*," and that he must do his work with the utmost thoroughness to insure success. By so doing his eyes will not be pained by the sight of sere and reddened trees in June, nor his cellars lack the red and golden harvest of October.

JOSEPH S. HOWE, *for the Committee.*

MINORITY REPORT.

The opinion of the undersigned, as one of the committee, is in brief to *let the canker-worms quite alone*, and if all apple-growers in any locality infested would omit using any *patent tree-protector*, *tar* or any other preparation, they would find that in two or three years the canker-worms would disappear from starvation, or lack of sufficient food, of a proper kind, to bring them to perfection, sufficient to propagate their kind for another year's operations.

I have come to this conclusion after careful observation and my own practice ever since the appearance of canker-worms in my locality. A majority of my neighbors have used every known remedy to save their *apple-crop*, but have met with very poor success, while those who have adopted the "*let-alone policy*," have done equally as well, and in some cases better.

In short, I consider all of the so-called *tree-protectors*, *tar*, *printers' ink*, *etc.* (except for puffing a worthless article), so much money and time thrown away.

Respectfully submitted,

WILLIAM BRICHER.

Statement of Thomas Sawyer.

TO THE COMMITTEE ON DESTRUCTION OF CANKER-WORMS: When the canker-worms in small numbers first made their appearance in my orchard, as many as eight years ago, I thought I would pay no attention to them; but as they increased very fast each year, I found I must do something, or my trees would be entirely destroyed. I commenced experimenting in 1870, by putting tarred paper and printers' ink on about one acre, or nearly one hundred trees, and the same number with paper and tar. I also put Ordway's Protector on forty or fifty trees. The Ordway Protector protects them from the grub, but not from the worm, as I found in the first days of April the worms were ascending the trees over the protector. I placed paper and tar above the protectors, and caught thousands before the middle of June, when every leaf was eaten. The ink was too expensive, as it was necessary to apply it every day, or at least every other day. I tried about one hundred trees with boxes, to which was attached a gutter filled with gas-tar, and which cost about fifty cents per tree. I also tried a few trees with gutters laid on the ground and filled with tar, which I found answered the same purpose. The cost was about fifteen cents per tree.

Last fall (1871) I put these troughs around four hundred trees, at a cost of about twelve cents per tree. The foliage of these trees was entirely eaten in 1870. The tar was stirred two or three times in the fall and the same in the spring.

Care must be taken to prevent the grubs from bridging over, or the gutter becoming filled with leaves. I found this to be a sure thing, if properly attended to.

This year the trees have not been eaten to injure the fruit. The foliage of the same trees was entirely destroyed in 1870. I shall have from two to three hundred barrels of good apples this year, 1872. If any one is interested in my method, I should be happy to give them any information I can, and the trees speak for themselves.

THOMAS SAWYER.

BOXFORD, Oct. 1, 1872.

THE HAY-CROP.

NORFOLK.

Statement of A. W. Cheever.

CHARACTER OF THE SOIL.

The character of the soil on my farm is very much varied, running from the best of drained meadow through several grades of loam up to poor, thin, dry, gravelly knolls, and consists of about twenty-five acres in mowing and tillage. The tillage includes over two acres of orcharding and as much more in corn-fodder, potatoes and gardens. Some corn-fodder and grass is grown among the trees in the orchards. The remainder of the cultivated land produces one or more crops of hay every year.

The land has been cleaned almost entirely of rocks and stones that would interfere with the free use of the plough, cultivator and haying-machines. The old stone walls have been removed to the low-land drains, until the whole farm, except seven acres of pasture, is contained in two lots separated only by a lane leading from the barn-yard to the pastures. As the principal crop sold from the farm is butter, and as it is desirable to obtain as large a quantity as possible, it is my aim to make the land produce the largest practicable amount of hay and other fodder, and have it of the very best quality for making rich milk.

OLD-FASHIONED STYLE OF RAISING HAY.

The old New England practice of our fathers and grandfathers, which still exists I believe on too many of our farms, of making corn, potatoes, pumpkins, white-beans and small grains,—as rye, oats and barley the principal crops, and hay a secondary one, has on my place been entirely abandoned.

Under the old system, after a field had ceased to produce enough hay to pay for the harvesting, it was given over to the cows, till in many cases it was no longer worth pasturing. It was then ploughed and planted with potatoes or corn, beans and pumpkins, or all of them together, for one, two or three years. And as almost every farmer had land that needed ploughing oftener than he could get round to it, he was tempted to plough up more each year than he could well manure. So a little manure was put in the hills which gave the crop just enough power to enable it to draw out about all the strength the land possessed. The next crops were either rye, oats or barley, sown without applying an additional coat of manure, which so reduced the fertility of the land that the grass-seed which was put in with the grain seldom showed itself, except the clover, till the second year afterwards. This system of rotation gave corn or some other hoed crops one or more years, then some kind of small grain sown with grass-seed, then clover, and on the fourth year from ploughing, provided it was planted but one year, English grass again. Then mowing-fields were always pastured after haying, and often till the grass was gnawed close down to the roots. This was the practice on my farm till within a few years. If the season was favorable, one or two fair crops of hay were obtained during the rotation.

HAY THE MAIN CROP.

Now hay is made the principal crop, and the others, if any are grown, are only secondary. The grass is treated with manure just as are other crops, and it is allowed the whole benefit of the land, very little grain being sowed with it, and it is generally manured with a light coat spread on the surface at the time of sowing. Even if the land is in pretty good condition a light dressing of manure spread on top of the ground and slightly harrowed in at the time of sowing, will

often make the difference of one crop the first year. The grass is pushed forward early in the spring, gets a start of the weeds, so that two instead of one crop can be cut the first season. For the sake of having the hay of the very best quality for producing rich milk and butter, all the better portions of the mowing are sown with such grasses as can be made to produce two or three crops in a year.

VARIETIES OF GRASS-SEED.

On the reclaimed meadow-land orchard-grass is grown as a principal crop, always giving three cuttings in a season. Herdsgrass is put a little higher up, and if top-dressed yields two good crops, while on the dry hills that are not good grass-lands, except in very favorable seasons, the redtop is sown, which never can be cut the second time. The different kinds are grown separately in a measure, so that haying may not come all at once, as the different kinds do not come to maturity at the same time by about fifteen to thirty days.

TIME OF SOWING.

I sow grass-seed both in spring and fall just as soon as a field is ready. At both seasons I like to have it in early,—the earlier the better. Sow winter-rye for fodder every fall, and am very successful with grass-seed at the same time. The rye comes off so very early the next spring that the grass has time to make a good growth that can be cut in August. On all fall-sown fields, clover is put on the following spring. I frequently lose the seed by its swelling before steady warm weather and then shrinking again and dying, unless it can be worked in a little with a harrow. If I lose it I re-sow it even the third time if necessary. I consider clover-seed cheap at any ordinary price to mix with other grasses. It takes but little value to sow an acre, and if it catches and does well it pays largely, while if it fails the loss on account of seed is quite small. Herdsgrass I very much prefer to sow in the fall early enough to get a good hold on the soil before winter sets in. Sometimes the grasshoppers do it great damage by eating off the young blades as fast as they come above ground; but if we do not sow we must not expect to reap. If herdsgrass is sown in spring, it is quite apt to be killed by the hot

summer-sun just after taking off the first crop, especially if it has grown fast and is tall and slender.

PREPARATION OF LAND.

I rather prefer to have the land to be seeded, previously planted with some hoed crop; but if I have fields that from any cause are not producing satisfactory crops, I do not hesitate to re-seed without planting. If to be sown in spring, I should want the ground well ploughed, cultivated and manured the fall before, so that I could get the seed in at the earliest moment that the ground could be made fit. In preparing for re-seeding, I am particular to have the furrows turned well over, all one way, by a swivel-plough that leaves no dead furrows or ridges, and not less than eight inches deep, so I can have a mellow top-soil of at least four inches for a seed-bed. Always pick up loose stones, and roll down smooth at the time of seeding. If only a light coat of manure is applied, it is always spread directly from the cart, as, if left in heaps, the grass is apt to lodge where the heaps were dropped, especially if left through a storm.

HARVESTING.

I always consider it safe to commence haying as soon as grass begins to lodge, whether it is in May, June or July. Cut all my hay and rowen with a machine. If the weather is steady and good for hay-making, cut in the afternoon after four o'clock. The next morning, after the dew is off, turn it two or three times, then, after dinner, rake up and put it in the barn as fast as possible, treading it down solid and keeping it as much as I can away from the air. Prefer to make it enough so it will not mould and turn brown, but choose to run a little risk of underdrying, rather then a greater one of overwetting, in bad weather. I do not object to putting in hay that will slightly heat in the mow, if it is free from any moisture except its own sap. I find that a great deal more hay can be stored in the same barn, if cut early, than if allowed to get ripe. To have it feed well to my cows, it must be cut and cured in such a manner and at such a time, that it will come from the mow soft and limber, instead of hard and wiry. If the hay-weather is not good, of course it takes longer to

make it. It must be cocked over night and covered, if need be, till it can be dried, either by the sun or the wind. I gather the hay with a horse wheel-rake the first day, and after the second day, when it has been cocked. I also highly prize the drag-rake, that enables a boy a dozen years old to keep the scatterings up with the team when carting, and to clean up after the horse-rake. I this year procured a Bullard's Improved Tedder. I am perfectly satisfied with it, and should not think I could get along without one through another hay-season. It cost absolutely nothing for repairs, and we made a number of lots of hay one day sooner than we could have done without, and thus escaped a storm and a great amount of hard work at re-opening and drying. Then sometimes there would be a little dash of a shower, just a sprinkle on our dry hay, that would have prevented its going into the barn, had we not had a tedder with which in a half hour we could make the hay as dry as before the shower.

HAY VS. ROOTS.

By the help of such haying-machines as the farmers can now command, I believe that on good grass-lands a farmer had better give his attention to raising grass and hay for his stock, instead of the heavy root-crops which require so much labor in planting, cultivating, weeding, hoeing, harvesting, storing and feeding out. If I could buy roots as I can get grain at less prices than I could afford to raise them for, I would like to feed a few every day through the winter to my dairy and growing stock. But at the present prices of labor, and with the present facilities for harvesting the hay-crop, I think I cannot afford to raise many roots. And with such hay as I can have by high manuring and frequent cuttings, I do not believe I very much need them. My cows are never troubled with indigestion or constipation when they are given a liberal allowance of good rowen.

PASTURING MOWING-FIELDS.

I do not believe in feeding rowen in the field. With mowers that easily cut an acre per hour, and tedders and rakes that will turn and gather it together in good weather ready for the cart in another hour, we can better afford to feed

the second crop in the barn, where the manure can be better preserved and where the cattle will be in no danger of cropping too closely or of pulling up the grass by the roots or of tramping into the ground. My mowing-fields are never fed by any animals.

I do not mean to mow later than the first of September; that gives time for another crop to come up sufficient to protect the life of the grass through a freezing winter. It is well known by observing men that the tops of plants cannot make much growth unless the roots grow also, and that the roots cannot increase without a corresponding growth of the tops. Now, when a heavy field of grass is cut in midsummer, the plants receive a shock, but with favorable weather for a few days they are enabled to recover and put on a new growth; but when cattle are turned on to such a field they keep the tops eaten down so closely that the roots cannot make a strong, healthy growth, such as will carry them safely through a severe winter.

TOP-DRESSING.

I practise top-dressing to some extent. If I top-dress at all, it is while the grass is thick and vigorous, instead of waiting till all the best varieties are exhausted. The best time for applying manure, I believe—other things being equal—is just after removing a crop. It then acts both as a mulch and a fertilizer. The question of top-dressing or re-seeding will probably remain an open one for some time yet, there are so many attending circumstances to be taken into the account. The cost of seed, the labor of ploughing and cultivating, the destruction of the sward by droughts, winter-killing or grubs, the impurity of the grass-seed in market that is full of foul weeds, all have a bearing that makes it necessary for each one to decide for himself, whether to top-dress or re-seed.

AMOUNT OF HAY CUT.

Of the gross amount of hay cut on my farm, I cannot give as accurate an account as I would like to, as I have no reasonable convenience for weighing the whole crop. I could give the number of loads drawn in, but that would not give others a very correct idea of the number of tons. I shall

leave the estimates to the judgment of the committee. The present condition of the fields and the prospects for next year's crops speak for themselves. The best I can do towards fixing the amount of hay raised, is to give the number of animals fed from the twenty-five acres:—Two horses, eight to ten cows, two to four yearlings, and two to four calves are fed very liberally from the hay-products each year, which is equal to a little more than one full-grown animal to every two acres of the whole farm, excepting that the cows are pastured in part, about one month, between green rye and the time of cutting corn-fodder. The calves and yearlings are also pastured outside of these acres, to a small extent.

I am sorry that it has not been convenient for all the members of the committee to visit the premises and judge for themselves of the comparative condition of the land which I have entered as a hay or grass farm.

A. W. Cheever.

Sheldonville, Oct. 30, 1872.

INDIAN CORN.

MIDDLESEX SOUTH.

Statement of Patrick McMahan.

The corn-field that I have entered for premium is plain land, and is a deep, dark soil, varying from five to ten inches, with strong yellow clay subsoil. The land was mowed five years. I will dwell here a few moments: All the statements that I have seen heretofore charge the corn crop with half the manure. This is an injustice to our most illustrious president crop. Where this idea was founded, I do not know, as all societies have failed in giving any explanation on this point. The "Ploughman" has also failed. I hope and expect they will give us an explanation in their next issue. I have tried to solve this point for myself, and I have come to a conclusion which I will try and explain to you.

Please come with me to the year 1865. The land my corn is on this year was planted with corn in 1865 on the sward

and manured similar to this year, but not near so heavy; however it produced a fine crop of corn; in 1866, a heavy crop of oats, not less than forty-five bushels to the acre; in 1867, a good crop of clover, two tons to the acre—second crop, rowen, not less than one ton per acre; in 1868 I had as good a crop of herdsgrass as I ever saw cut—two and a half tons or more to the acre; in 1869, a handsome crop of red-top, not less than one and a half tons to the acre; 1870, about one ton per acre. Seventy-one came in dry, and the land I believe was entirely run out, and produced what the Dutchman calls *nothing*—seven to eight hundred to the acre. Leaving out the Dutchman's crop of 1871, I had four heavy crops of hay on this land after the oat-crop, which I think, and am almost sure, averaged two tons to the acre for four years after the oat-crop. Now, gentlemen, if the corn-crop took half the manure and the oat-crop the other half, please tell me, if you can, what made the four aftercrops of hay, which surely averaged two tons per acre for the four years? Let us suppose, for a moment, that the corn-crop did take half the manure, you charge all the carting, spreading and harrowing. This is also an injustice to the corn-crop, as it should be only one-half.

I have heard a great many farmers say it does not pay to raise corn, and it is no wonder, as it is always charged with a third more expense than belongs to it, which ought to be distributed back to the aftercrops of hay; then our most illustrious president crop would receive its due merits which it has been defrauded of for all past time.

Gentlemen, these are quack farmers that say it does not pay to raise corn, when they can buy it for seventy-five cents per bushel. They generally go to work with their gloves on. They also say that farming does not pay at all. Now I will try and convince these gentlemen farmers that it does pay to farm, and also to raise corn. I know a man of my size in the town of Southborough; his general crop has always been the corn-crop. From November 1, 1867, to November 1, 1872, that is five years—and he says that he can and will prove by cash and satisfactory written documents, and by human evidence—he has cleared, free of all expenses, eight thousand five hundred dollars; besides, in that time his capi-

tal in stock has improved at least five hundred dollars. He goes still further, and says the improvement of his farm is sure cash in bank to the amount of one thousand dollars. If this statement is to be relied upon, it would amount to the small sum of ten thousand dollars. During that time he has sold no wood from the place. He is ready and willing to come before the board and prove this statement. So much for the quacks and gentlemen farmers.

I have prepared and manured the land for my potatoes the same as for the corn. I harvested and weighed six hills of corn. I also dug six hills of potatoes beside the corn, as an experiment. The result was: Sixteen and one-eighth pounds of corn, twenty-three and three-quarters pounds of potatoes. Twenty pounds first quality potatoes, worth one cent per pound; second quality, three and three-quarters pounds, worth one-half cent per pound—making twenty-two cents for the potatoes. Corn at one and a half cents per pound, twenty-four cents—leaving out the fraction; one bundle of top-stalks, two cents; but-stalks, two cents—making for the corn twenty-eight cents; besides the potato-seed cost five per cent. more than the corn. I think I can drop and cover two acres of corn in the time that it will take me to drop and cover one acre of potatoes.

You see, gentlemen, how the corn-crop defies all others. I have seen in Mr. John Johnson's statement of 1871, that his corn cost him forty-two cents per bushel; and I think his experiment and explanation worthy of the commendation of all practical farmers, though I have heard a great many quacks actually discrediting his statement and saying that corn could not be raised for forty-two cents. I will try and show them that it can be raised for less. When you travel on the road and meet a field with a fine growth of weeds, almost covering the corn and other crops, there lives a quack farmer. He may get fifteen to twenty bushels of corn to the acre—poor quality at that.

Gentlemen, I have tried to explain my idea on the merits of the unrivalled corn-crop. I will now give you my idea on the preparation of the soil. I have already described the quality of the soil and crop of 1871. Ploughed, the first part of May, 1872, three acres and a half, six inches deep.

Expenses $14, one-half this year, ...	$7 00
Value of manure at cellar, $8 per cord, eight cords per acre, making twenty-six cords to the lot, one-third this year, ...	69 32
Carting, $7 per acre, one-third this year, . .	8 00
Spreading, $4, one-third this year, ...	1 33
Harrowing $6, one-third this year, ...	2 00
Cultivating after harrowing, $4, one-third this year, .	1 33
Bushing $3, one-third this year, ...	1 00
Furrowing, ...	4 00
Planting, May 18, ...	5 00
Seed, three-fourths bushel, ...	1 50
Cultivating and hoeing twice, ...	30 00
Thinning to four stalks in a hill and sprouting, .	4 00
Hacking weeds in August, ...	6 00
Cutting and taking up stalks, ...	10 00
Total expense, ...	$150 48
Husks for harvesting.	

Cr.

By one thousand one hundred and four bundles top-stalks, at two cents per bundle, ...	$22 08
The committee measured one rod by a sworn surveyor, and harvested the same; net weight $68\frac{1}{2}$ lbs., making 150 bushels per acre; allowing 72 pounds, amounts to 525 bushels to $3\frac{1}{2}$ acres; 525 bushels corn at $1 per bushel, ...	525 00
	$547 08
Deduct expenses, ...	150 48
Balance, ...	$396 60

There is one point that my mind is not quite settled on—that is, half the ploughing of the land this year, which I hope the society will explain by some evener head than mine. I believe that one-half the ploughing should be charged to the after hay-crops with one-third of the manure, one-third carting, one-third spreading and harrowing; the other one-third

to English grain-crop. My field was marked exactly three and one-half feet apart, and kept entirely free from weeds. If the society offered the inducement of fifty dollars for our best president crop, the golden corn, and fifteen dollars to the foot-race, I think it would be a good change to all in favor of corn-raising and farming in general. I wish them all prosperity.

PATRICK MCMAHAN.

Statement of George H. Taft.

FRAMINGHAM, Oct. 17, 1872.

The field of corn which I enter for premium contains one acre and two rods; the soil is a dark, deep brown loam, little inclined to gravel. The field has been mowed for the last twenty-one years, and the last year it cut about half a ton to the acre. The piece was ploughed May 15th, nine inches deep, with a Doe plough, and harrowed the 20th; the manure, composed of the droppings of three cows, five yearlings, and one horse through the winter, with some cords of good loam put in last fall and well worked over this spring, of which four cords and two feet were drawn directly from the cellar to this piece of land, and spread on the 22d and 23d, and ploughed in with a No. 0 Nourse plough, four inches deep; then well harrowed with a common harrow, and marked out three and one-half feet each way, and planted on the 26th with the corn that I bought of John M. Harrington which took the first premium last season at the fair, five kernels to the hill, top of two hundred and seventy-five pounds Bradley's phosphate, spread in each hill about three inches square, the corn dropped directly on the same, and covered one-half inch deep. The corn was up in four days after it was planted, and on the 8th of June it was cultivated, thinned out to four stalks, and hoed; and hoed again on the 19th, without cultivating, for the reason that it was too large to go through with the horse.

Expense of ploughing, ...	$5 00
Carting manure, ...	5 00
Spreading manure, ...	1 00

Harrowing,	$3 00
Striking out,	75
Seed-corn,	1 00
First cultivating and hoeing	4 00
Second cultivating and hoeing,	4 00
Cutting stalks,	2 00
Value of manure at the stable, per cord,	6 00
	$31 75

BRISTOL.

Statement of Rotheus H. Reed, of Easton.

The crop of corn which I entered for premium grew on a sandy loam; lot measured one acre. The manner of cultivation was as follows:—

In 1871 it was planted to corn; in 1872 spread on about five cords of stable-manure, ploughed in about eight inches deep; harrowed and furrowed; used one barrel of phosphate in the hill when planted. I finished planting May 22; rows three and a half feet one way and two feet the other, four kernels in a hill; ploughed and hoed twice, stalks cut about the first of September.

EXPENSES.

Seed-corn,	$0 60
Five cords manure,	25 00
Carting,	3 00
One barrel of phosphate,	7 80
Spreading and ploughing,	4 00
Harrowing and furrowing,	1 00
Planting and hoeing,	9 00
Cutting stalks,	3 00
Harvesting,	7 50
Total,	$60 90

Harvested 109$\frac{5}{7}$ bushels of corn.

Statement of Elbridge G. Dean, of Taunton.

The crop of 1871 was hay, no manure used. The crop of 1872 was corn; used five cords of barn-yard manure; about the middle of May it was spread on and turned under from eight to ten inches deep; harrowed and furrowed about three feet one way and eighteen inches the other; three cords of manure put in the hill. Planted the 19th and 20th of May; used twelve quarts of yellow corn; hoed the middle of June; pulled the weeds the last of July; the stalks were cut the first of September; harvested in October. Quantity of land 160 rods.

EXPENSES.

Manure,	$40 00
Ploughing,	5 00
Harrowing and furrowing,	2 00
Planting,	4 00
Corn,	40
Hoeing,	3 00
Pulling weeds,	2 00
Cutting stalks,	2 00
Harvesting,	5 00
Total,	$63 40

Harvested 96 bushels of corn.

ROOTS AND VEGETABLES.

ESSEX.

Statement of J. D. W. French.

MANGOLDS.—The land occupied by this crop was measured by the committee and found to contain 22,720 square feet, something over one-half acre. The committee then measured off one-twentieth of the whole piece, which was considered an average lot, to be weighed at harvesting. This I have done, and the weight was 1,800 pounds, which would give as the yield of the whole piece 36,000 pounds, or eighteen tons of mangolds.

The crop of 1870 was grass of very poor quality and small in quantity. The land had been in grass many years, and most of it was low and wet. In the summer and fall of that year I drained the whole piece, of which this is a portion, with tile-drains.

The crop of 1871 was corn, and from two and a half to three cords of stable-manure were used. The soil varies from a peaty to a gravelly loam. The manure was carted on and ploughed in during the autumn of 1871, and the land was cross-ploughed in the spring. The depth of the ploughing was from seven to eight inches. The seed was sown May 17, by machine, in drills about thirty inches apart. The plants were thinned out to twelve or fifteen inches apart in the rows. In reckoning the labor, although more than one man and also horses were employed, I have calculated the time on the basis of one man's work for a day.

Dr.

4 cords of manure,	$40 00
½ bushel agricultural salt,	22
1½ days' ploughing,	3 00
2½ days' ridging and sowing,	5 00
6 days' hoeing and thinning,	12 00
5 days' harvesting,	10 00
4 pounds seed,	3 00
Interest and taxes,	4 00
Total,	$77 22

Cr.

36,000 pounds, or 18 tons of mangolds, equal to 600 bushels at 25 cents per bushel,	150 00
Balance to Cr.,	$72 78

As we are considering only the marketable portion of the crop, we have not taken into account the leaves, which according to analysis are as valuable as the roots themselves.

It might be a matter for consideration also as to how much of the manure remains in the soil for future crops. The use

of the salt was simply an experiment based on analysis. Johnson gives three-fourths to one and a fourth per cent. of saline matter to the mangold (root).

J. D. W. French.

Statement of J. J. H. Gregory.

Squashes.—I enter for premium my crop of Hubbard squashes. They were grown on several different pieces of land, all on the same farm, the aggregate measure of which was six and four-sevenths acres. All the land had been in tillage for several years. Most of it was a strong loam, underlaid with gravel. The crop was planted between the 20th and 25th of May. The manure used was very rich, too rich for this very wet season, causing an excessive growth of vine. The manure was a compost of muck, barn-manure, glue-manure and fish. About eight cords were applied to each acre and thoroughly worked in by plough and harrow. The hills were nine by ten feet, and at the ultimate thinning two plants were left in each, which, as the event proved, was just one too many. Were it not for some danger from the attack of the borer, I would never leave more than one vine to each hill.

COST OF CROP.

Six and four-sevenths acres of land, rent of,	$100 00
52 cords of manure and spreading of same,	520 00
Ploughing of land,	36 00
Harrowing and cultivating,	20 00
Planting,	9 00
Seed,	12 00
Cultivating four times,	15 00
Hoeing four times,	25 00
Liming once,	4 00
Cutting and collecting,	15 00
Total,	$756 00

VALUE OF CROP.

42 tons at $40 per ton,	$1,680 00
Deduct cost,	756 00
Profit,	$924 00

MARBLEHEAD, 8th Nov., 1872.

This is to certify that I have this day measured the several tracts of land on the farm of James J. H. Gregory, Esq., that were planted to Hubbard squash the past season, and have found them to contain six and four-sevenths acres.

FRANKLIN REYNOLDS.

Statement of J. J. H. Gregory.

CABBAGES.—The piece of American Improved Savoy Cabbage which I enter contains 27,000 feet, on which the cabbages by actual measure are two feet apart in the rows, while the rows are three feet apart. The number of plants on the piece, suppose every space to be occupied, would be 4,500. As there are about one hundred missing spaces, the actual number is about 4,400; of these five-sixths will average seven inches in diameter and are worth on the ground ten cents a head. The remainder, taken as they run, are worth on an average four cents a head. I do not think there is a cabbage on the piece that has not advanced so far as to form a head. This variety of Savoy I consider of superior excellence for market purposes, from the fact of its being so reliable for heading and making so large a head on so short a stump. This piece was raised on an old onion-bed; hence the quantity of manure to the acre was less than I am in the habit of applying, it being at the rate of about four cords to the acre. The quality of the manure was very superior, it being made up of a compost of barn-manure, sea-manure, glue-manure and fish-heads and sound bones. The seed was planted about the 20th of June in the hills, which were two feet apart, while the rows were three feet apart. The crop received the usual treatment of three cultivatings and three hoeings. The cabbage-worm was fought with a compound made up of twenty parts air-slaked lime, three parts superphosphate and one part of carbonate of lime. The compound *appeared* to be efficacious, but this, my first test, demonstrates nothing, although my acre of Marblehead Mammoth Drumhead, to which it was applied several times during the season, appeared to receive a decided benefit.

COST OF PRODUCTION.

Manure teamed and spread, 4 cords,	$40 00
Ploughing of land,	3 00
Harrowing and cultivating,	2 00
Marking out and planting,	4 00
Seed,	2 00
Thinning out,	2 00
Applying compost and cost of,	4 00
Three hoeings,	8 00
Three cultivatings,	8 00
	$73 00
Hire of land,	20 00
	$93 00

3,665 heads at 10 cents,	$366 50
733 heads at 4 cents,	29 32
Total,	$395 82
Subtract cost,	93 00
Profit,	$302 82

Cabbages of all kinds are very dear this fall, which makes the profits of a good crop figure remarkably high.

MARBLEHEAD, Nov. 8, 1872.

This is to certify that I have this day measured the piece of land on the farm of James J. H. Gregory, Esq., on which his Improved American Savoy Cabbages are now growing, and find it to contain 27,000 feet.

FRANKLIN REYNOLDS.

Statement of J. J. H. Gregory.

CABBAGES.—I enter for premium one lot of Stone Mason Cabbage, containing an area of 47,808 feet. This piece was planted June 12th, the seed being dropped into hills averaging two feet apart, while the rows average three feet apart. The land, which was in sward, was broken up this spring and received a good coat of very rich manure, at the rate of eight

cords to the acre. The manure was a compost of muck, clay, rotten kelp, herring and the heads and sound bones of fresh fish with some glue-manure. The manure was worked in by Shares' harrow. The crop received the same treatment as the piece of Savoy, with the exception that the cut-worms having worked badly, much of it had to be replanted in parts several times over.

The cost of production was as follows :—

Interest on land,	$16 00
Manure and spreading,	90 00
Ploughing,	6 00
Harrowing and cultivating,	3 00
Marking out and planting,	6 00
Seed,	3 00
Thinning out,	3 00
Applying compost and cost of,	7 00
Three hoeings,	13 00
Three cultivatings,	12 00
Transplanting into vacant spaces,	3 00
	$162 00

VALUE OF CROP.

5,976 heads at 11 cents each,	$657 36
1,584 heads at 6 cents each,	95 04
	$752 40
Deduct cost,	162 00
Profits,	$590 40

In estimating value of crop, I have put it at two cents less per head than the present value of cabbages, of equal quality, in Boston market, and have allowed about one hundred as the number of vacant spaces on the piece.

I have deducted three hundred and sixteen from the crop, that number not having formed heads of any market-value; still, such cabbages have a value, for by protecting them over winter in a growing position, nearly all will make good market heads by spring.

James J. H. Gregory.

MARBLEHEAD, 8th Nov., 1872.

This is to certify that I have this day measured the piece of land on the farm of James J. H. Gregory, Esq., on which his Stone Mason Cabbage are now growing, and find it to contain 47,808 feet.

FRANKLIN REYNOLDS.

Statement of Dudley H. Porter.

HAMILTON, Nov. 12, 1872.

SWEDES.—The land on which the ruta-bagas which I offer for premium grew, has been in English grass for the last eight years. Ploughed the first time in November, 1871; cross-ploughed again this last June and harrowed; finished June 20th; sowed in drills about three feet apart. The crop is one hundred and ninety-six bushels, sixty pounds to the bushel, on the half acre, worth in market sixty-two cents a bushel.

Value of two and one-quarter cords of manure,	$18 00
Labor and team in hauling and applying the same,	5 00
Seed,	60
Cultivating and weeding,	6 00
Transplanting,	2 00
Two ploughings and harrowings,	6 00
Harvesting,	7 00
	$44 60

Market-value,	$130 40
Cost,	44 60
Income,	$85 80

DUDLEY H. PORTER.

ESSEX.

Statement of Benjamin P. Ware.

MANGOLDS.—In the fall of 1870 the half acre of land upon which this crop grew was broken up, having been in grass for six years, and in 1871, four cords of compost-manure was applied and potatoes planted. This land was formerly very

wet; having since been drained by a box-drain running through it two feet below the surface, it has become fit for cultivation. The soil is dark and heavy, resting upon a hard, gravelly subsoil. A compost-heap was made upon the land last fall by first a layer of peat-muck, one foot deep, then sea-kelp green from the beach, same depth, then a layer of muck and another of kelp. In the spring, as soon as the frost would permit, the whole was forked over three times at intervals of a week or ten days, by which it was completely mixed and pulverized. This, to the amount of six cords, was spread on and ploughed in eight inches deep and harrowed. After a week it was ploughed again the same depth, which brought the manure to the surface, then the pulverizing-harrow was used until the manure was very thoroughly commingled with the soil, after which the surface was dragged smooth, making as perfect a seed-bed as could be desired.

On the 12th of May two pounds of seed of the Norbiton variety were sown in drills two feet apart. Just before the seed came up, salt was spread broadcast on two-thirds of the piece, at the rate of twenty-five bushels per acre. The crop was hoed and weeded three times, and at the second weeding the plants were thinned as nearly as possible ten inches apart. The mangolds were pulled, topped and piled up in the field and covered with the tops to protect them from frost on the 29th of October; after remaining ten days were stored in the cellar.

Owing to the large amount of rain this season, the crop was injured on about one-half of the piece, fully thirty per cent. Water stood on the surface a day or two at a time on several occasions before it drained off, the drain being wholly under ground.

I observed that the effect of salt upon the crop this year was not nearly as marked as in some other instances. The year before salt more than doubled the crop. That was a dry season and this a wet one; whether that was the cause of the difference I am unable to tell.

It will be noticed that, with the exception of the salt, the cost of the manure applied was only the labor of carting and preparing, as the muck and sea-kelp were products of the farm.

COST OF RAISING THE CROP.

6 cords of compost at $5,	$30 00
Laying out and spreading,	5 00
8 bushels salt at 25 cents,	2 00
Ploughing,	4 00
Harrowing and dragging,	3 00
2 pounds seed at 75 cents,	1 50
Sowing,	75
Hoeing, weeding and thinning,	12 00
Harvesting,	14 00
Total,	$72 25

The weight of the crop nine days after being pulled, 19 tons, 10 cwt. 78 lbs., market-value $15 per ton,		$293 08
Allowing $2 per ton for marketing,	$39 25	
Cost of raising,	72 25	
		111 50
Profit,		$181 58

BENJAMIN P. WARE.

HINGHAM.

Statement of Mr. Albert Fearing.

BEETS.—I enter for premium two-thirds of an acre of beets. The soil is a sandy loam, in corn last year, ploughed twelve inches deep, and ten cords of manure applied; rows eighteen inches apart; hoed three times.

PRODUCT.

41 tons of beets at $10,	$410 00

COST OF CULTIVATION.

Ploughing,		$6 00
Cultivating,		16 00
Harvesting,		30 00
10 cords of manure,	$100 00	
¼ less,	25 00	
		75 00
Seed,		2 25
Total cost,		$129 25

I also enter for premium two-thirds of an acre of ruta-bagas. The soil is a gravelly loam, in grass last year; ploughed nine inches deep, and twelve cords manure applied; rows eighteen inches apart; hoed twice.

COST OF CULTIVATION.

Ploughing,		$6 00
Cultivating,		16 00
Harvesting,		12 00
Seed,		25
12 cords manure,	$90 00	
⅓ less,	30 00	
		60 00
Total cost,		$94 00

ALBERT FEARING.

HINGHAM, Nov. 8, 1872.

FRUITS.

ESSEX.

From the Report of the Committee.

PEARS.—The most noticeable pear upon the tables was the Bartlett, of which many fine specimens were presented, and which generally succeeds better than any other variety. There were also very handsome specimens of the Beurre Clairgeau, which would have done credit to any exhibition, but as this pear is so variable in quality, it should be planted with caution. The Doyenne Boussock was large and fair, and we believe this to be a good market variety.

Excellent reports and essays on pear-growing have appeared in former "Transactions" of this society; but as they have probably been forgotten (if ever read) by the present generation of fruit-growers, your committee thought it might be well to offer a somewhat extended report upon the general management of the pear, hoping it would draw attention to the subject, which we believe to be an important one. When

we find, by the census returns of Massachusetts a few years ago, the apple and pear crop, amounting to something over one and a half million dollars, and in a year, too, when the apple was almost an entire failure, we realize something of the importance which this crop is assuming.

We believe that pears can be grown at a much greater profit than apples, especially on our *best land*, in the immediate vicinity of our growing towns and villages; and are fully of the opinion (and that opinion has been formed from observation), that no more suitable soil is to be found in the Eastern or Middle States for successful pear-growing, than is found along the coast of this State and New Hampshire. It often appears as though our sea breezes, or a taste of salt in the subsoil, had an ameliorating effect upon the fruit. But however this may be, it is pretty certain that the trees have received more care and attention near our large cities on the coast than in the interior. The pear delights in a deep, rich soil, inclined to clay, or clayey loam; yet we often see very good results on a light, or sandy loam soil. Some varieties, as the Buffum or Louise Bonne, do best in a light soil, while others, as the Duchesse and Beurre Diel, require a damp and rich one. Fifteen or twenty years ago, when apple-orchards were in their glory, and apples were plenty and cheap, very little attention was given to pears, except near the cities. But those days have passed away, with the appearance of the canker-worm, the borer, the apple-worm and excessive droughts, and now not one apple-tree is planted where there were a hundred then. With the present prospect for apples, it may yet appear that apple-trees are worth preserving. There has been of late much complaint of the so-called Dwarf pear, and probably for most purposes the standard is much the best; but at present we will confine ourselves wholly to the *standard* pear, or that worked upon the pear stock, and afterwards shall have a word to say in favor of the *dwarf*, or that worked on the quince stock.

The first thing to be considered in planting the pear, whether by the person who plants a few trees for family use, or by him who plants more largely for profit, is a suitable soil. None of our land is too good; choose the best—such land as would raise *heavy* corn, grass or vegetables—deep

loam, or better if inclined to clay. If it is so wet that water will stand upon it two or three days after frost is out, *underdrain* it; if it is so damp that it will not work well and *pulverize* for a week or two later still, underdrain it; not with stones, merely covering them a foot or two, but thoroughly and sufficiently with tiles. To any one who has never tried, it is surprising to see the effect of thorough underdraining, even on any common crop; and the cost is not so much as people would at first suppose. When land is underdrained extensively, the cost does not generally exceed forty dollars per acre, when the tiles are three and a half to four feet deep and thirty to forty feet apart. Who that owns a garden would not willingly pay this small amount, rather than always have his land wet and unfit for trees, or even early garden vegetables? We would not wish to infer that only land which is damp enough to need underdraining is suitable for pear-trees; but the drier the land the more will it need to be enriched.

It is important that pear-trees should have *shelter*, or protection from the wind, both in summer and winter. Perhaps the principal reason why they do so much better in city lots than in the country, is that they are so much better sheltered by buildings, fences, shade-trees, &c. In planting pears in the open country, choose a location, if possible, where the wind is broken off on the west and north (or better on all sides) by a belt of trees, hills or buildings. When there is plenty of good land and no shelter, it would be advisable to plant belts of trees around it. Probably there is nothing better or more economical for the purpose than a single row of Norway spruce, planted four or five feet apart around the most exposed sides. The white or Scotch pine would do very well if the land was cheap, and sometimes arbor-vitæ makes a fine wind-break, but it is more apt to winter-kill than either of the others. If the soil is not rich, it should be made so by heavily manuring at least a year before the trees are planted.

Many people are careful to select none but *large* trees to plant, thinking they will bear much sooner than small ones. If these could be taken up with all their roots, and quickly and carefully re-set, they would, without doubt, bear in a very

short time; but in the way they are generally taken up, leaving most of the roots in the ground, and planted leaving on all the top, they are apt to linger along for years (if they live at all) before recovering from the treatment. A moderate-sized tree, with a *vigorous*, healthy growth and plenty of good, fibrous *roots*, will generally in five years be better than the large one, transplanted as above; but for orchard-planting, or for a hundred or more trees, we would advise not to take more than two or three years from the bud, but those the *very best* selection. Trees are often much injured by exposing the roots to the sun or wind. We should remember that all their nourishment is derived through the *small* or fibrous roots, and a few hours' exposure of these to a drying or cold wind will injure them more than a journey of weeks, when the roots are protected with damp moss or litter.

In planting, the holes should be dug deep and wide, say two or three feet deep and as many wide; the subsoil should be thrown to one side and replaced with top-soil. A little old fine manure, worked well in with the dirt in the bottom of the hole, will do no injury, but no new manure should be used around the roots. The tree should be planted as deep as it formerly stood in the nursery. Those who have only small gardens will always be well repaid for "trenching" the entire plot eighteen to twenty-four inches deep. In that case no deep holes to be filled up will be necessary. It is important (but often neglected) to cut smooth the end of every root before planting, for however well the trees may be taken up with the spade, the roots will be left rough and broken. In planting trees, a person should not be afraid to get upon his knees and make good use of his hands. Every root and fibre should be carefully straightened out, and fine soil be well worked in, so that every cavity may be packed full. Here is one great secret in transplanting trees of any kind, to have the dirt come firmly in *contact with every root*. Do not, as is sometimes recommended in books, lift the tree up and down to work in the dirt, but hold it perfectly still till finished. No water need be used, unless the ground is very dry, when a pailful may be thrown upon the roots after they are covered, and the dirt drawn over that. As soon as the ground becomes

dry enough around the tree, press it down *firmly* with the foot, and if the weather continues dry go over the trees again, drawing up more dirt and stamp it down as before. Very large trees may require staking to keep them in place, but for those of common size this will not be necessary.

The next operation will be "head-in" the tree; cut off the superfluous limbs, and *cut back* all the remaining branches, according to their growth and the amount of roots. The tree as it stood in the nursery, as nature formed it, had roots to correspond with the top. A large portion of these roots were necessarily left in the ground, and ought not a part of the *top* to be taken off to balance the tree? Trees with plenty of roots, that made a small growth the last season, will often do well without much heading-in; but those that have grown vigorously ought to be cut back severely—better nearly all the last year's growth. This also applies to the *peach* and other fast-growing trees and shrubs. When the hot, dry weather commences in summer, a heavy mulching will be found very beneficial to newly-planted trees.

As to the best time for planting there is a variety of opinion. Our own experience would favor early spring, just as early as the ground is dry and fine, though if the trees are *dug* early and kept back, it is just as safe in May as in April. Where the ground is not wet, *early fall* planting is generally successful and by many preferred. The distance apart again is a subject of opinion. Our own advice would be to plant closely, from twelve to fifteen feet, though it depends considerably upon the variety; some will die out every year, and after they commence well to bear, will grow very slowly. This will give three hundred and twenty-five to the acre, and fifteen feet from each other, two hundred. When the trees are young, any low crop, like strawberries or garden vegetables, will not be objectionable, nor when they are older, if it will be borne in mind that *surface-roots* must not be cut off. A better way after five or six years is to *manure heavily* every fall, especially around the trees, and level-off and work in slightly with a fork in spring; then to cultivate with a horse during the season, not working deeper than three or four inches.

After the first year the trees will need very little pruning,

except to shape and keep them well balanced. Some varieties, as the *Urbaniste*, will naturally grow in a regular pyramidal shape, while others, like Rostiezer, will need considerable heading-in to make them compact.

The pear, like all other trees, is subject to diseases, perhaps the worst of which are "leaf-blight" and "frozen-sap blight." It is a serious fault in a tree or variety to loose its leaves in summer or early fall, while one which has healthy and *persistent* leaves is to be preferred. The curculio and other insects sometimes attack pears, but the injury is not often serious. We should encourage the *small birds* in every possible way as the best protection from insects. The canker-worm, the borer, the tent caterpillar and the codlin moth, which are so destructive to the apple-crop, have not as yet troubled the pear; though the "web-worm," or fall caterpillar, shows a decided preference for the pear and should always be destroyed.

Of the *profit* of pears there can be no doubt. But perhaps some will say if they are generally planted and cared for as we have described, it will not "pay"; they will become a drug in the market. Having carefully watched the market for the last ten years, we are free to say that the price of good merchantable fruit has constantly advanced. Sometimes early August pears have been a drug, and have been sold at low prices, as have also the first-gathered of that most plentiful of all pears,—the Bartlett; but this has been owing to having "windfalls" and immature fruit forced upon the market, and that, too, in the height of the peach-season. What wonder is it that people should prefer peaches to half-grown, flavorless pears? Those who have thinned out their fruit and left it upon the trees till fully grown towards the last of the season, have obtained good prices. Well-grown Bartlett pears readily sold at four dollars per bushel in any of the cities of this county for the last three seasons by the middle of September, and a week or ten days later were worth six or eight dollars in Boston, though probably the average price through the season was not over three or four dollars. Could not the growing of this pear be made a *specialty* by some of our farmers in this vicinity, and would they not readily find a market by the hundred barrels in New York, Philadelphia, Baltimore or Port-

land and the cities further East? Bartlett pear-trees, in ten years from planting, ought to yield a bushel to a tree on an average every year, taking the whole orchard through. We know of some on a small scale which have done much better than this. Any one on reflection can see the difference between this and the profits of apple-orchards.

The marketing of fine fruit is quite a trade, as is also the picking and ripening; but this can be readily learned when enough is raised to make it an object.

We propose to name a few varieties in the order of their value for market and family purposes, and first will be the *Bartlett*,—of vigorous growth, adapting itself to a greater variety of soil and climate than any other, and of such wonderful productiveness that young trees often bear to a fault; of good quality, though connoisseurs speak of a disagreeable "musky flavor," still it is readily accepted by the "million," and bought in preference to the *Seckel* or *Belle Lucrative*, and is without doubt our most profitable market pear. The *Beurre d'Anjou*, coming a month or six weeks later, is very highly prized by those who know it best. A hardy and vigorous tree, a regular but not over-abundant bearer, fruit of large size, good quality, with an abundance of vinous juice. It is an October pear, but will keep well into November, and will always command a high price. Six dollars per bushel was the wholesale price offered last year by dealers around Boston. We are told of one tree in the western part of this State, the fruit of which in one year was sold for $100. The *Lawrence* is a pear of which the more you know the better you will like it. Any one who is not pleased with a Lawrence pear in its season—November and December—is hard to suit. The tree is a very slow grower at first, but after it becomes well established is strong and vigorous. It is, taking the county through, one of the most hardy trees known, and is becoming more popular every year. Fruit of medium size, and quite sure to ripen up yellow, and then it is sweet and delicious. The *Sheldon* is a pear of later introduction; very few trees in this vicinity are yet of bearing size: the largest one we know bears regularly as abundant crops as the Bartlett. Fruit large, russet, and of the finest quality; October; tree very vigorous and hardy; same with *Doyenne Boussock*,

though the fruit in quality would hardly come up to the Sheldon, still it is good, large and fair, and very profitable for the market. But this report will hardly permit of a description of the *Vicar*, *Beurre Bosc*, one of the *best*, but a poor grower, *Belle Lucrative*, *Howell*, *Seckel*, *Onondaga*, *Clapp's Favorite*, *Urbaniste* (a *splendid* pear, but tardy bearer), *Merriam*, *Rostiezer*, *Tyson*, *Bloodgood* and *Doyenne d'Ete* (these last sparingly for profit), and the *Buffum* for sandy ground where others will not succeed. These are all tried varieties, and no one will go very far astray in planting any of them; but the danger is in getting *too many* rather than too few kinds, and we should rather confine ourselves, however extensive our orchard, to about half a dozen varieties.

Dwarf-Pears, or those budded on the quince stock, (and it should always be some strong-growing variety, as the Angers or Paris,) should always be grown in the *pyramidal* or bush form, and should branch within one or two feet of the ground. It is well to plant close, and not allow them to attain a large size. In selecting dwarf-trees, choose those that were budded near the ground, and do not plant them too deep, just cover the bud and no more. We are aware that many successful fruit-growers recommend covering the bud five or six inches in planting, but it is not our practice. If the roots grow very deep in the nursery, cut off a portion of the bottom in replanting, as no tree will flourish for any length of time with the roots deep in the wet, cold soil. The roots of all trees need the heat of the *sun*, especially for perfecting the fruit. The great advantages of dwarf-pears are the comparative earliness with which they come into bearing, the small space they occupy and the improvement in the quality of the fruit. This last perhaps would only apply to certain varieties. But few kinds succeed well on the quince, and *only* those should be selected. The quince-roots are tender and should be covered every fall; many dwarfs were killed last winter which a good mulch around the roots would have saved. After they are large enough to bear, a wheelbarrow-load or two of *manure* in autumn is a good protection, being careful that it does not afford a harbor for the mice. Do not let dwarf-trees overbear; very little fruit should be allowed to remain on for the first few years, and it is always well to thin out at least one-

half. Dwarf-pears do best in a dark, *rich* soil, sheltered from the winds,—just such as we should suppose many of our city-gardens to be, and not such as are many gardens in the country.

There is now standing in a garden in Newburyport a dwarf Duchesse tree, which in a single season produced five barrels of pears that were sold in the city of New York at $20 per barrel.

But do not expect too much, failures will often occur. The Duchesse and Beurre d'Anjou, referred to above, are the exception and not the rule. And if these few hints should be of service to any fruit-grower we shall be amply repaid for offering them.

A few varieties recommended as dwarfs, in order according to their value, would be *Duchesse*, *Louise Bonne de Jersey*, *Vicar of Winkfield*, *Beurre d'Anjou*, *Belle Lucrative*, *Urbaniste* and *Rostiezer*.

T. C. Thurlow, *Chairman.*

STOCK.

MIDDLESEX SOUTH.

Statement of Sturtevant Brothers.

In pursuance of our custom and the former requirements of the society, we offer this year, with our herd of Ayrshires, the following statement :—

NAME.	Age. Years.	Weight. Sept., 1872.	Calved.	Yield, Lbs.		
				June.	July.	August.
Imp. Twinney, 1,910, .	7	–	Jan. 27,	712	618	544
Imp. Edna, 1,101, . .	6	910	Mar. 24,	793	707	629
Imp. Lady Kilbirnie, .	6	855	Apr. 12,	1,036	844	777
Fannie, 69, ...	11	955	June 7,	942	1,039	909
Imp. Georgie, 1,232, .	6	890	June 27,	110	955	837
Imp. Ops., 1,695, . .	7	–	July 24,	–	217	971
Average, . . .	7	–	May 4,	871	832	778

Feed: June.—Pasture and 32 quarts corn-meal daily between 14 head. July.—Pasture and 20 quarts corn-meal daily (with the exception of six days) between 14 head. August.—Pasture and 39 quarts corn-meal daily between 14 head.

[The grain account for the several months, as given above, represents the amount carried to barn from granary, and is somewhat in excess of the quantity actually consumed by the cattle.]

On account of limited pasturage grain has been fed to economize grass.

The effect of an omission of the grain for a limited period s seen in the following:—

Six days, July 3 to 8 inclusive, grain fed 11 cows; milk, 1,649 pounds.

Six days, July 9 to 14 inclusive, no grain fed, 11 cows; milk, 1,580 pounds.

Six days, July 15 to 20, inclusive, grain fed 11 cows; milk, 1,613 pounds.

The influence of an omission of the grain for the season would probably have been more manifest as affecting the flow of milk and condition of the animals.

All the cows but one are imported animals, and have their pedigrees given in full in the "Transactions" of the society for 1870 and 1871.

Sturtevant Brothers.

South Framingham, Sept. 16, 1872.

WORCESTER.

From the Report of the Committee.

Jerseys.—The committee suffered some embarrassment from the unfavorable weather, and could not be so critical in their examination as they desired. The animals were all in good condition, and of marked excellence, and both of the large herds have been bred with much care and with good success in the maintenance of a strong family resemblance, which the committee wish to recognize with much commendation. This is of acknowledged importance in perfecting any breed, and especially Jerseys. The Jersey breed is very

decided in its characteristics. A cow giving poor milk is seldom found, and one from whose milk a large quantity of excellent butter, in proportion to the quantity of milk, cannot be made, is, we believe, yet to be reported. The animals are extremely docile and even affectionate under kind and quiet treatment, but nervous and wild under harsh usage; and under such treatment the bulls become cross and dangerous at an early age. In size they are small, as compared with other thoroughbred stock, but your committee believe that by careful breeding much improvement has been and can still be effected in these respects.

The points of excellence recognized by breeders of Jerseys are also so clearly defined that any one who will give to the subject careful observation, can become expert and arrive at satisfactory results. This was quite apparent to your committee in their examination. In making their selection by marking off four cows from each of the two large herds for the best herd of four, four of the committee selected three of the same cows, and the other two selected two of the same three, and a similar result occurred several times in making up the awards; all indicating that the cows had been well-bred and that the committee were governed by the same general standard.

Your committee were gratified to notice that the Jersey stock received its full share of attention from the public, and that remarks from farmers and others derogatory to their general appearance were not heard. It has been the custom of many persons to decry this stock at fairs and elsewhere; but its excellence is now generally recognized. In quantity of milk even, it is proven that the average of a well-selected herd for twelve months, in pounds or quarts, is very near the average of Ayrshires, which is considered the best milking-stock, and that the number of pounds of butter which such herds will produce exceeds that made by any other breed, while the price at which Jersey butter can be sold in the cities and large towns is nearly double that of first quality common butter.

For these reasons, and others which might be adduced, your committee feel warranted in calling general attention to Jersey stock, and in commending it to milk-producers and

consumers, believing that the latter will find Jersey milk at twenty per cent. advance on the price of common milk the cheapest and most satisfactory as an article of food, while the former will soon demonstrate that the best returns come to them, on a long average, from the same source. In places remote from cities, where the product of beef is a leading object, and where young stock is cheap, the keeping of Jerseys is not urged by your committee, nor would we recommend that importations should be made at the prices it now costs; but that inasmuch as good thoroughbred animals can now be had for a reasonable price, that persons who keep one or more for personal use and profit, and those who keep herds to supply good milk and butter to those who are willing to pay for what superior living costs, should give the preference to such animals as were shown at your exhibition.

In selecting this stock it does not follow that all cows for which the highest price is asked are the best to buy; but it is very desirable that careful selection should be made, and that every good strain of blood should be kept free from poorer mixture, as it is as easy to adulterate in cattle-breeding as in anything else. Probably the best purchases can now be made from the surplus of good herds—certainly better than from importers and dealers, whose principal object is to make money, and who, in some instances, sell inferior animals, the only recommendation of which is the fact of importation.

It seems to be the general impression that Jersey animals require extra good care in order to secure from them a good result. Your committee has no disposition to controvert this opinion. In fact we would admit and emphasize it. We believe that each of the herds exhibited at your fair have produced twenty per cent. higher product for the last year than they would have done if they had received the hap-hazard treatment many persons bestow upon one of the most beautiful and valuable animals given to man by the Giver of all good. One member of your committee has a Jersey cow, not above the average size, which gave the last year in three hundred and twenty-three days, the time between calves, 6,577 pounds of milk, and during twenty-eight days of this time was dry, it being twenty and one-third pounds per day for

the whole time, or twenty-two and one-third pounds per day for the whole time which she was milked, or six hundred and seventy pounds every month; every pound of which could have been sold at four and three-quarter cents, or thirty-two dollars per month. Shall such an animal be neglected, abused, kept on short feed, covered with filth and vermin, and scarcely out of a chill the whole winter; while perhaps in the next stall there may stand a horse of little value to the owner as a source of income, which is petted, blanketed, groomed and fed with great care and cost, and upon which no wintry blast is allowed to blow. Now, we do not object that such a noble animal as the horse should be thus treated, but we do ask for the cow similar treatment, and we are confident that in the case of every well-bred cow such treatment, while it will scarcely cost more, will surely add largely to the product as well as to the comfort of the animal, and place the owner's name in the catalogue of merciful men.

Your committee desire to make some suggestions which the society may deem impertinent, but which result from the labor and difficulty of making up decisions satisfactory to themselves, on the stock exhibited. Animals of the Jersey breed merit premiums for what they will do in milk and butter, while other breeds are judged of more especially for beef. The qualifications for the latter are apparent to the eye, while the milking quality of any animal is not so easily estimated; hence, it may be questioned whether some rules for decisions would not be of value in the examination of Jerseys which would be unnecessary for Durhams and Ayrshires.

It might not be wise to adopt a scale of points of such elaborateness as is given in the herd-books, although the scale is the standard for judgment in the English fairs, especially on the Channel Islands; but if all premium cows were required to show some of the leading characteristics of extra quality, and those were known, all breeders would be governed by them, and exhibitors and examiners would readily appreciate them. An illustration of the difficulties which meet your committee may be given by a statement of the case of the committee which presents this report.

The committee of five were from points remote from each other, were slightly acquainted if at all; knew little of the

knowledge possessed by each of the subjects committed to them, and nothing of the standard by which each would form his opinion. Two herds, of about twenty each, were submitted, from each of which five worthy animals were to be selected for the first premium in the list, and one of these two selections was to be awarded the premium. Now, might it not be reasonably expected that very diverse opinions would be entertained by these gentlemen of the different animals in these herds, as to their value for quarts of milk and pounds of butter, and the difficulty be the greater in proportion to the thoroughness of the breeding or the careful selection of the herds, in the absence of any recognized standard of excellence or scale of established points?

There are in Jersey cows certain physical conformations which are decided indications of good quality, and as to which there is general agreement, although experts differ in their estimate of their importance; and there are some features highly regarded by some persons and disregarded by others. Now, if a committee were governed in their selections, to some extent, by points recognized by all, the labor might be much facilitated.

And again, in the matter of pedigree, your rule is that animals admitted are to be recognized by the committee as thoroughbreds; but shall a committee of experts give the first premium for a cow, which, in their judgment, is one-sixteenth or thirty-second Ayrshire? She may be a superior cow and deserving of a premium, but she is not a Jersey, and a committee should not be compelled to endorse the fraud.

Now, in the judgment of your committee, every society should adopt a scale of points, not numerous nor difficult to distinguish, but indicative of the leading prominent characteristics and features of a good Jersey bull or cow, so that the award of a premium will be of some value beyond the amount of money paid. The pedigree of all animals should be accessible to the committee, and a history of each animal for some period of time during the past year be given the committee, if required. The animals should be placed at the exhibition so that they can be viewed at all points, front as well as rear, and there should be an area into which they could be led so as to compare them side by side.

21

A Jersey is a "thing of beauty," and requires and will reward a different examination from other herds for reasons before given. It is gratifying to those who prize them highly that they receive so much attention, and your committee believe that they will attain a higher appreciation, year by year, if they receive the fostering attention of agricultural societies of such renown as the Worcester Society, and the discrimination from breeders manifest in the herds which came under the examination of your committee.

GEO. H. JONES, *Chairman.*

HAMPDEN.

From the Report of the Committee.

In connection with this report the committee would take the occasion to add briefly a few general remarks concerning the milking qualities of our domestic cows. Without doubt these qualities are the result of *care and breeding*, and are the two essential requisites which should never be neglected in producing a race of animals capable of furnishing the largest amount of good rich milk. The first requisite is the breed. By this we mean a class or order of animals possessing not only the general characteristics of the species, but other qualities peculiar to themselves as a class, the result of careful selection and the influences of nourishment, treatment, soil, climate, &c., and which characteristics they are capable, with a good degree of certainty, of transmitting to their progeny. It becomes, therefore, a matter of the first importance to make that selection which embraces in a marked and decided manner those peculiar qualities which are to be found in certain breeds of cattle, and then by a careful discrimination to so develop and increase the desired qualities, either by crossing with others of similar traits, or infusing fresh strains of the same breed from those which have exhibited such qualities in an unusual degree, until such characteristics shall become permanently established.

To obtain a breed of cows which shall invariably transmit their milking qualities, requires close observation and thorough knowledge of the rare and difficult art of breeding. It cannot be accomplished by the careless, slip-shod method pursued by

most farmers. Nor is it a matter of guess-work; the results can as well be predicated and are as reliable as the raising of good fruit by the use of scions from trees producing such fruit; the process is by no means so simple, but it is equally as certain. Nor are the difficulties to be overcome insurmountable. With careful study and close observation and the use of good sense, these certain and important results are attainable; and when we consider the relative importance to every farmer of the difference between a good animal and a poor one, all this necessary care and effort is readily appreciated. Taking into consideration the fact that in this section of country the milking qualities of the stock are of primary importance, it is absolutely necessary that only those cows should be used for breeders which have exhibited in a preëminent degree such qualities, and also that those from which they have sprung have likewise been similarly distinguished. The fact that a cow is in herself a good milker, but whose ancestry has never shown any great excellence in this particular, is no evidence that she will transmit this quality to her offspring. There must be an inherent power, the result of a long and careful process previously carried out in the progenitors of the animal to insure this successful result. How often have we known of sad disappointment by overlooking this established principle. It is an uncertain risk to breed from animals whose good qualities are merely accidental. Such animals may produce good stock if bred to bulls which have come from well-established breeds, although even with this advantage the certainty is not so probable. Yet it is far better to do this, because a fresh strain of pure blood would be introduced which will, if subsequently sustained, assert its influence, than because the cow having no such record is served by a "scrub," with no possibility for improvement. Every good cow, possessing "good marks," should always be served by thorough-bred bulls coming of stock distinguished for the qualities required. By this means, with judicious management, in a short time an improvement is begun which may ultimately establish a stock of the very best and most desired qualities.

When we consider the cost of raising and keeping stock, the character of our farming region, the quality of soil, the variableness of climate, our long, cold, tedious winters, re-

quiring "barn-feeding" for many months, our best interests would, it would seem, dictate in terms too plainly to be misunderstood, that the profit and success of dairy stock must necessarily depend upon this prime requisite of "breed."

Fortunately at the present time the defects of an ill-bred ancestry have in a large measure been remedied, and all that seems necessary is to select from the improved races of both sexes and by careful and intelligent discrimination in crossing raise up a stock distinguished for dairy purposes. We say of both sexes, for it must always be kept in mind and is a rule never to be deviated from that to improve and establish any permanent quality only those are to be used as breeders which are distinguished for possessing in an eminent degree the required quality. And this is true of not one of the sexes, but of both. How often have we seen breeders raising stock from their best cows with the strongest expectation of success, doomed to disappointment notwithstanding all their care and expense as well as loss of time by simply neglecting to make a right selection of the sire of the offspring. If the female possesses the requisite qualities, never run the risk of any chances with other than thoroughbred bulls of similar qualities,—"it will not pay."

It should also be a rule never to allow the female to accomplish her *first* conception with an ill-bred male. It may not be democratic, but it is true, nevertheless, that in this case at least only royal strains of blood can produce royal offspring, which shall not only exhibit but transmit their royal qualities.

It is a curious fact that the first conception frequently influences those which follow it, and the subsequent offspring may exhibit qualities similar to the male which begot the first. A writer upon the subject of "Human Generation" remarks, "That the human female, when twice married, bears children occasionally to the second husband which resemble the first both in bodily structure and mental powers." The manner in which this influence is exerted is unfathomable, but it is indisputable. Seeing, then, that if in the human species "the bodily structure and mental powers" may be thus singularly transmitted, why may not the same be true of the lower animals? It undoubtedly is so. Very many farmers, however, (who we suppose are ignorant of this fact), will allow their

young stock to be impregnated for the first time by any "runt of a bull," simply to bring them "into milk," when, if they prove good milkers, will then breed them with a full blood. This is a bad method and should never be done, for the first calf, if the rules of proper breeding are observed, is equally valuable as those born later, while the chances of transmitting the poor qualities of the first bull are greatly increased.

It is an old proverb "that from nothing nothing can come." Begin, therefore, from the first start with the very best that you can possibly obtain, then improve as rapidly as possible. The present breeds are, undoubtedly, vastly superior to those which have preceded them. But that is no reason why there should be no further effort for improvement, and a race of animals be produced that, for dairy purposes, shall far exceed their ancestors in their large and generous milking qualities.

In breeding milch cows the disposition of the animals should never be overlooked. A quiet, gentle, docile disposition is of the first importance in a cow. An animal which is to be handled so much and so often should be as free as possible from all ugliness of temper. A cross, kicking, irritable milker is to say the least undesirable. So, also, is a nervous, high-strung, fretful creature. Undoubtedly a great deal of this intractability is owing to their education. Still something is due to the natural inherent qualities of disposition and temperament.

These mental and moral qualities should, therefore, receive due attention in raising such stock, and in their education the utmost care should be exercised in restraining and correcting the bad qualities and developing good ones. Beginning early in their calfhood, dealing gently with them, by kindness and soothing treatment even bad tempers may be made mild and good ones improved.

A quiet, gentle, contented animal is not only more desirable for handling, but can be more easily kept and at less cost. Possessed of a quiet disposition she will be less likely to be affected by her surroundings, and calmly "lives her life away," happily, contentedly and usefully.

The second requisite, is the care, which such stock receives, in developing and increasing their milking qualities. The good sense of every intelligent farmer would naturally suggest

to him the necessity of giving his cows the very best care possible, and it would seem that nothing was needed to be said upon this point; but, certainly, in observing the manner in which many persons treat their stock, it would appear that it was of small consequence. Although a good breed is essential to the development of the highest qualities, yet, after all, even common varieties, with the proper care and feeding, can be made nearly equal in productiveness to the thoroughbred.

As to good grades, the only difference is the greater certainty in accomplishing it with the latter rather than with the former. This shows, very conclusively, how much can be accomplished when attention is given to the care and feeding. A plenty of good food is not alone necessary; it is, to be sure, one of the principal factors in the problem, but without the other factor, good care, it loses half its value.

But what are we to understand by good feeding and good care? By good feeding we mean a suitable supply of nourishing food, and of such variety as is capable of affording the means of producing the largest product of milk, and keeping the animal in good, hearty, thriving condition. The food should be given in proportional quantities, at regular intervals, systematically, and in regular order. There should be enough and none to spare at each feeding, to insure its being eaten, while at the same time the stomach is not overladen, and can easily digest it, and the appetite is thereby not cloyed. We have not space to enter into the detail of the different kinds of food, such as relates to their elements of nutrition or milk-producing qualities. We can only speak in general terms, leaving those minute details, which can be found in the more elaborate works which we would advise every farmer to study carefully.

By good care we mean all that which relates to the comfort of the animal, such as warmth, cleanliness, shelter, ease in the stall, etc. A good shelter, free from all winds and draughts, should always be provided. No animal can be comfortable in a barn with large cracks between the boarding, or open or half-closed windows and doors, through which the frosty wintry wind finds easy ingress. Shivering and pinched with the cold, how is it possible for any animal

to do much more than live? Or, if not in even so poor a shelter as this, to be turned out into the snow to stand for hours, vainly endeavoring to increase its animal warmth? Under such conditions the food, instead of making milk, is used up in making animal heat.

Observe how often the cows are covered upon the posterior parts of the body with loads of excrement, increased by daily additions. Many farmers make their cattle, for weeks together, stand upon the accumulating manure, with a mere sprinkling of straw until the poor creatures are hock-deep in the filth, or, if frozen by the cold, with the hinder parts so elevated that all comfort is impossible; and here in such stalls reeking with the excrements, together with the impurities of the air vitiated by their own breaths, cows are expected to be healthy and furnish large supplies of milk.

It is horrible to contemplate the filthy, as well as unhealthy and execrable condition in which some farmers stall their cattle. It is absolutely inhuman to subject these dumb animals to such treatment. Stock, which in cold weather is confined so much in the barn, should have a clean and even place or floor on which to stand and lie down, out of the manure, and plentifully covered with straw, so as to protect them from the dirt and add to their warmth. No manure should be allowed to accumulate on their bodies; they should be carded and rubbed down, and the skin kept as free as possible from dust and dirt. The health of the animals depends largely upon the condition of the skin, and this should be daily attended to, that it may be kept in a wholesome condition, so that the insensible perspiration be not impeded and the effete matter which finds its exit from the body through this process not be prevented. The manner in which cattle are confined in the stall is of great importance. Enough freedom should be allowed to permit of their lying down at ease, without being crowded too closely and being interfered with by their neighbors. They should have space enough to change their position, and relieve the tedium and discomfort of remaining too long confined to it.

That old English word "comfort," so expressive and meaning so much, should be the motto written on the door of every stable in which dumb animals are confined, and its meaning

should be thoroughly known and appreciated by those who have the care of them. This same idea of comfort is as well-nigh understood by animals in their sphere as by man; therefore, see to it that they have it in large abundance.

With these two requisites, "breed and care," intelligently carried out, the certainty of success is well-nigh assured. If we take into consideration the quantity of milk, with its different products, produced by the cows of the country, we shall see at once how important becomes every detail in its production as well as increase. According to the statistics the value of the annual products of milk is nearly equal to the value of imports, for the year ending June 30, 1871. Milk consumed as food, at three cents a quart, is worth, annually, $275,000,000; butter, $195,000,000; cheese, $29,000,000; condensed milk, whey, and buttermilk, used in raising pork, $10,000,000. Furnishing a total of $509,000,000. The imports of all kinds, were $520,000,000. This clearly shows what an important industry the production of milk has become.

As an article, therefore, of human food, containing all the needed elements of nutrition, and entering so largely into the great variety of different kinds of food, it has become preëminently a "staple article," almost indispensable to the welfare and comfort of the race; it ought, therefore, to be produced in abundance and afforded at a cheap rate.

P. LeB. Stickney, *Chairman.*

Springfield, October 5, 1872.

Statement of Myron C. Graves.

Milch Cows.—The cows which I offer for exhibition are all of them "grade Durhams," numbered as follows:—

No. 1, aged seven years, calved June 1, 1872; weight of milk per day the second week from calving, fifty-six pounds.

No. 2, aged six years, calved February 1, 1872; weight of milk second week from calving, fifty-four pounds.

No. 3, aged six years, calved December 15, 1871; weight of milk, fifty-three pounds.

No. 4, aged seven years, calved July 17, 1871; weight of milk, forty-nine pounds.

No. 5, aged twelve years, calved February 2, 1872; weight of milk, forty-nine pounds.

No. 6, aged three years (second calf), calved September 15, 1872; weight of milk September 20, forty-six pounds.

No. 7, aged seven years, calved October 29, 1871; weight of milk, forty-eight pounds.

No. 8, aged ten years, calved April 10, 1872; weight of milk, forty-five pounds.

No. 9, aged eight years, calved in the spring of 1872; weight of milk September 1, thirty-six pounds.

During the winter-months I feed hay and in summer "fodder-corn," and in addition each cow receives per day eight quarts of corn-meal, or sixteen quarts of wheat-shorts, or nine quarts of rye-shorts, or twenty-four quarts of "brewer's grains," or a portion of these at times mixed together, as I consider a change and variety of feed of great importance, because it seems to keep the stomach in better condition and gives a heartier relish for the food.

I give salt twice daily immediately after eating the grain; the stock is then watered, in winter using warm water.

The stock is kept in a dark stable which is kept thoroughly clean and dry, standing on a plank-floor, bedded with sand and straw. Each cow is tied with a rope and is carded and groomed carefully every day; on pleasant summer nights they are turned into a dry enclosure.

I attend to the stock myself and see that their wants are properly supplied, and my management carefully and systematically carried out. Respectfully,

M. C. Graves.

Springfield, Oct. 1, 1872.

HOOSAC VALLEY.

From the Report of the Committee.

Bulls.—For the first time the committee were directed to award premiums only to animals having a satisfactory pedigree as thoroughbred. This distinction was given in obedience to the mandate of the State Board of Agriculture directed to all the incorporated agricultural societies in the Commonwealth. With this rule the committee have no fault to find.

Although at its first introduction it may have worked some inconvenience to the exhibitors and have been the cause of disappointment, if not of apparent injustice in some cases, and moreover of no small embarrassment to the committee, they nevertheless believe that, in the long run, a strict compliance with it will not fail to be of great benefit to the stock-raising interest of this community.

Careful experiments conducted for long periods of time, both in this country and in England, whence most of our improved breeds of cattle come, have settled the fact that the only sure, and at the same time, rapid method of improving a given herd of native or mongrel stock, is to breed from thoroughbred males. Especially is this true in the improvement of milk-producing animals. With this deduction of experience, the principles of animal physiology as expounded by its most eminent professors, agree.

Since, then, the true end for which the society exists at all, and for which it receives the bounty of the Commonwealth, is to secure the highest possible excellence in this as in every other department of industry within its scope, it is manifestly both wise and just that its premiums should be awarded only for such *methods*, *processes* and *products* as shall best secure the desired result.

The committee believe that considerations like these fully justify the wisdom of the rule adopted by the Board of Agriculture for the guidance of the societies under its supervision. They believe that a cheerful and honest compliance with it cannot fail to direct the attention of our stock-raisers to the vast importance of a more careful study of the principles and methods of breeding, and so to awaken a deeper and more intelligent interest in a most important branch of husbandry,—one to which a large portion of our territory is so well adapted. With such an interest aroused, we see no good reason why the agricultural wealth of this region should not be multiplied many-fold within a brief term of years.

In applying the rule of the society, the committee, desiring to be neither too technical nor too lax in their judgments, agreed that when the evidence as to the pedigree of any animal should be such that they would be willing, without further inquiry, to purchase it as a thoroughbred, it should be satisfactory.

In concluding this report the committee remark that it is a matter of just pride to notice the improvement made in this department of husbandry since the formation of the society. At its first exhibition it is believed that not a single thorough-bred animal of any breed was presented. To-day all the leading breeds are represented, and of most of them there are several valuable herds owned by members of the society. Let the good work thus begun go on, and the time will not be far in the future when the exhibitions of our society will rival in this department those of the oldest and best-conducted societies of the Commonwealth.

J. White, *Chairman.*

NANTUCKET.

From the Report of the Committee.

Grade Stock.—Had we been permitted, we should have commenced our awardings with the highest grade of each class, and worked downward to the half-breeds; but we were restricted by the rules of the society to the consideration of all alike in respect to gradation of breed and pure blood, if they were half-bloods. Hence we have decided on the merits of each cow in comparison with others in appearance, with reference to keeping and milking qualities. Grading is all-important to stock-raisers, as it is the only means of determining with any degree of accuracy, the qualities of the off-spring. If parties admire and esteem the highest type of the noble Ayrshire and fawn-like Alderney, shown in these grades, it argues the purer blood the better cow. It is not our immediate duty to speak of bulls in this report, yet it is a matter of great importance to look to it, and not encourage the raising for breeding of any but the pure blood. Our society have very properly refused to offer any award for any but the pure type. The slightest curve is a deviation from the straight line in this matter, that will diverge wider and wider annually until the pedigree is lost in the distance.

It is but repetition for us to write upon the subjects which are so nearly connected with the rearing, feeding and treatment of cows. Our farmers are more familiar than we are with these topics, and we have ocular demonstration in the

fine display of well-fed animals and excellent milkers, that their owners are well-read and experienced dairymen. Yet there may be some exceptions in our county to a proper system of feeding, care and treatment, and a few hints may be *apropos*. We have witnessed the treatment of this meek and gentle animal which calls for a word from us. Whipping, kicking, pounding men and boys should not be tolerated in the stalls where cows are milked, nor should a rude, destructive boy be permitted to drive them to and from the pastures. They are naturally very timid, and becoming frightened are rendered vicious where they were otherwise docile. Cleanliness is an important consideration in our barns as in our stables, with our cows as with our horses. Every intelligent groom combs and curries his horse with great care, and he will tell you it is essential to his well-being so to do; that it does him almost as much good as his daily food; yet we have seen great negligence with regard to cows in this respect. Why will not the same rule apply to them? It most assuredly will, and they should have a thorough currying and brushing daily. One advantage would result to the cow's comfort from this cleansing: the barn floors would be kept cleaner to save labor on the cows. Diet is another important subject. An eminently successful farmer and dairyman in our county, changes the food in the mangers at morning and evening, and says cows thrive better to have a variety of food daily; that they require it at times for their well-being.

The principal breeds from which our grades have been produced, are Ayrshire and Alderney, in the proportion of thirty Alderney to twenty-five Ayrshire descent, and a few mixed half-Alderney and Ayrshire.

The Ayrshires, as you well know, were originally from the county of Ayr, of English descent, and originated from a cross of Shorthorns at a time when this race was more generally distinguished for milking qualities; they have been credited with an infusion of Alderney blood, and this supposition appears to be borne by the light stripe round the nose, often noticeable in Ayrshire calves; they have been for a great number of years an established race of cattle which have been unequalled for yield of milk. We would submit

for your consideration, a few statistics from an accurate record of the Maple Herd of Ayrshires kept near Fitchburg in this State.

The product of a herd of seven for three years, yearly average of each in quarts of milk, 3,010.

Herd of eight for three years, yearly average of each in quarts of milk, 2,984.

Herd of ten for three years, yearly average of each in quarts of milk, 2,769.

Herd of two for three years, yearly average of each in quarts of milk, 3,300.

Milk-product of one cow, "Beauty," in three years, 1869, 1870 and 1871, yearly average in quarts of milk, 3,700, or 11,000 quarts in three years.

The Alderney in appearance supports the Darwinian theory by forming a link between the ox and the deer. Calves have the appearance of fawns; this race is celebrated for gracefulness and beauty; very gentle and fond of petting; has a remarkable faculty of converting all its food into very buttery milk, and will afford rich returns for its keeping. The types of these breeds will be transmitted in exact proportion to the thorough-breeding done, and it is much to be desired that all the thoroughbred bulls and cows may be retained, and their numbers increased annually in the county; otherwise the strains of blood in our grades will disappear in a few years, or be so faint in outlines as to be invisible. The wise keeping of stock may be summed up in a few essentials, viz.: Good and abundant food, comfortable shelter, proper ventilation, regularity in milking and feeding, cleanliness and kindness; these six; but the greatest of these is kindness. These few suggestions, hastily written, may meet the eye of some who have not troubled themselves to adapt their wishes and inclinations to the animals' comprehensions, and to study their nature, want and conditions. We congratulate our society upon the fact that the number of this latter class in the county is very limited.

ALEX. MACY, JR., *Chairman.*

POULTRY.

BRISTOL.

From the Report of the Committee.

We were pleased to observe a very great improvement in the coops of ducks and geese. The Rouen seems to be the favorite, and deservedly so, as no breed is more beautiful, and it is one of the largest and most prolific. The drakes of this variety are especially handsome, their markings being identical with the wild Mallard. Nothing, except perhaps the hues of the peacock, can excel the beauty of the iridescent green of their heads and necks, the lower part of which, girdled by a ring of pure white, presents a delicious contrast of color. There is perhaps no family included under the head of poultry more interesting than our aquatic fowl, whether we regard them for their beauty or for their valuable qualities under favorable conditions. For one who has the eye of a naturalist, or is a lover of nature, who loves to investigate the haunts and habits of the Black Duck, Mallard or Eider, there is a never-failing source of amusement and instruction in the breeding of these beautiful birds.

As in former reports much has been said concerning the gallinaceous fowl, we hope a little space devoted to our aquatic birds will not be without interest to some who have as yet turned their attention chiefly to Brahmas, Dorkings, and that ilk. Perhaps a poet's description of the Mallard, of which the Rouen is the improved progeny, may not be out of place :

> "Oft as the sun's last lingering ray
> Gleams faintly o'er the fading scene,
> By some still lake I bend my way,
> Where decked in plumage brown and gay
> The Mallard oft is seen;
> With glossy neck of emerald hue,
> And wings barr'd with the deepest blue
> That sapphire gives; and ruddy breast,
> By the clear dimpling waters press'd;
> To sedgy covert swimming near
> Where on her nest of rushes made,
> His mate in humble garb array'd,
> Broods o'er her eggs with anxious care."

These lines give us a charming glimpse of their habits, in a nutshell, and may furnish a hint as to their proper management when domesticated. There is no family we believe which so largely preserve their wild instincts in captivity. A flock of wild ducks feeding or swimming by the sea-shore, if viewed attentively through a good telescope, will be found to go through precisely the same motions as their domestic brethren in the most contracted pond or running stream; the same plunging motion of the head and neck, and the same habit of every now and then raising the body at right-angles with the water and fluttering their wings. The presence of ducks therefore in a barn or farm yard seems to furnish a certain breezy suggestion of far-off wilds and romantic surroundings, which is of itself a recommendation to any one who has a love for the untrodden mysteries of nature's most remote fastnesses.

We have alluded to the close similarity of the domestic to the wild varieties. We have a singular proof of this in an experience we once had with a black Cayuga duck. This breed is supposed (the poultry-books say) to be a cross between the black duck and some other wild variety. This is no doubt true, for there is no domestic duck which is so quick and agile in its movements; but the authorities say that one of their recommendations is that a fence a foot or two high will keep them in, as it will no other duck, and here our experience proves directly the contrary. On our return home, after an absence of two or three months, we were sorry to find that, by some unexplained casualty, one of our black Cayugas had lost the use of one of its legs, which upon examination proved to have been badly broken and twisted. As the parts had long since knit together it was too late to remedy it. The poor duck was totally unable to walk, and could not stand except for a second or two on one leg.

Our barn-yard was surrounded by a high picket-fence, at least ten feet high, and strange to say, this duck had attained the facility of flying over it as easily as a pigeon. On one or two occasions she was brought back to us from a neighbor's barn-yard which was separated from ours by at least an eighth of a mile, and surrounded by very high hemlocks and cedars; to reach it she must have flown at least fifty feet high.

She at last became so troublesome from her truant propensities, that we had to have her killed. It is interesting as a remarkable instance of nature's law of compensations, and does it not prove pretty conclusively that the black Cayuga is only a slight remove from a wild stock?

The most approved breeds are the Rouen, White Aylesbury and Black Cayuga, but our country is very rich in its varieties of wild ducks, and there is but little doubt but that some of them might easily be domesticated. The dusky black duck is easy to tame, and makes a valuable cross with any of our larger breeds. The Eider, or as it is called here "the Isle of Shoals duck," feeds on corn readily, and would be a valuable addition to our poultry on account of its great quality of fine down, which commands a good price in the market. The "Canvas-back" and "Red-head" ducks, so famous for their game flavor, might no doubt be domesticated, and would make valuable crosses with other breeds, though we are not aware that the experiment has been tried.

Wherever there is a running brook or a swampy meadow ducks can be kept to advantage. At some seasons of the year they will forage for themselves, so that a small quantity of grain only is necessary. They should be regularly fed however, particularly in the evening, so as to induce them to come regularly to the barn-yard, where they should be confined during the night, as many eggs will be lost if they are suffered to run at large.

Duck-eggs for the most part should be set under hens, as these make the most careful mothers. If a quantity of fresh horse-manure is placed under the nest the young will be much stronger and hardier. We have had broods hatched in this way, in one instance as many as thirteen, every one of which lived to maturity, while we have never been so fortunate when they were hatched in the ordinary nests, consisting of straw only. It is well to have a brood or two hatched under ducks, for the reason that drakes brought under hens are very apt to chase them in the spring of the year, and are sometimes very troublesome. The young ducks should be kept from the early dew to prevent catching cold and getting "the cramps," of which many die every year. It is important that they have plenty of water to drink, but *very little to swim in*

until they are at least four or five weeks old. Young ducks, unlike chickens, feather very slowly, and the only feathers that appear early are those of the tail. These should be clipped with a pair of scissors, as they become wet and draggled whenever there is any dew on the grass. These are useful precautions to take when the young are hatched under hens. With ducks as mothers, in favorable situations, it will be as well perhaps to leave them to their maternal instincts. We have always observed that ducks having free access to running water or a swamp, after the first few weeks, grow more rapidly and make larger birds.

Muskrats are very fond of young ducks, and therefore these should be guarded against.

Ducks when well fed are very prolific layers. They have been known to lay ninety days in succession without intermission. Of the domestic ducks the Rouen has the most game flavor, the meat being the darkest. The White Aylesbury, though brought by high feeding in some instances to as great a weight as eighteen pounds, and a great favorite in the London market, we have found very deficient to keep a standard weight, as compared with the Rouen and black Cayuga. Their pure white plumage, pinkish white bills, and beauty of form make them great favorites where they are known, and no more beautiful contrast of color need be wished for than a sheet of water stocked with these and the Rouen and black Cayuga.

Geese.—The Bremen geese of David B. Evans and Theodore G. Lincoln were especially fine. There is no breed which more completely approaches perfection, whether we consider the snow-white hue of their plumage, or their great size. The Indian Mountain geese exhibited by the same gentlemen were also noble specimens.

The goose is the closest grazer of all living creatures, not excepting sheep, and it might be a cheap method of procuring fine turf for a lawn to have a flock of these birds pastured upon it for a year or two. The finest turf we almost ever saw is to be found along the roadsides of the island of Rhode Island, near Newport, where flocks of geese are continually grazing.

Gallinaceous Fowl.—(*Plymouth Rocks.*)—This breed is

fast becoming one of the popular favorites. Its name, like many other breeds of poultry, is a misnomer, it being entirely unlike that established by Dr. Bennett of Plymouth. It is undoubtedly a cross of the Dominique with some of the large breeds. It is a bird of admirable form with bright Dominique plumage, and clear yellow legs. Some doubt has existed hitherto as to whether it was sufficiently established to breed true, but the chickens exhibited were as true to the old fowl as young game to their parents, and nothing more need be asked for, as every poultry-fancier well knows. It would be an ornament to any farm-yard, and its good qualities are claimed to be equal to the Dominique fowl, than which few, if any, are better.

EDMUND RODMAN, *Chairman.*

PLYMOUTH.

Statement of Lucius Dunbar.

Dr.

March 1.	To 27 chickens on hand at $0.50, . .	$13 50
	31 hens " 1.25, . .	38 75
	3 cocks " 1.50, . .	4 50
	5 hens and 22 chickens, bought, .	10 50
	1 cock, " .	1 00
	2 ducks, " .	2 50
	14 bushels corn, cracked, . .	11 84
	16 " "	13 94
	14 " meal, ...	11 80
	1 bushel barley, ...	1 25
	89½ pounds meat, ...	3 09
	300 " wheat screenings, . .	5 30
	2 bags oatmeal, ...	2 82
	6 pounds sulphur, ...	54
	1 cask lime, ...	2 00
	oyster shells, ...	95
	40 dozen eggs set, ...	12 00
	2 " "	2 50
Total,	. . . .	$138 78

Cr.

Sept. 21.	By 46 chickens on hand, at $0.75,	. .	$34 50
	23 " " 50,	. .	11 50
	36 " " 25,	. .	9 00
	24 " " 12½,	.	3 00
	3 cocks " 1.25,	. .	3 75
	20 hens " 1.00,	. .	20 00
	6 ducks " 1.00,	. .	6 00
	85 chickens sold,	. . . .	97 77
	15 hens "	. . . .	15 32
	8 ducklings "	. . . .	4 75
	137½ dozen eggs sold,	. . .	53 56
	11 barrels manure "	. . .	25 00
	2 " " on hand,	. .	4 00
Total income,		. . . . . .	$288 15
Less expenditures,		. . . . . .	138 78
Balance, profit,		. . . . . .	$149 37

DAIRY PRODUCTS.

WORCESTER WEST.

From the Report of the Committee.

Butter.—Nothing as yet has been discovered that adds anything to the natural flavor of butter, but still it is an open question whether we have arrived at perfection, as regards milk and the uses we make of it. I, for one, think we have not, but that there is something yet to be learned. How many of us farmers know anything about the constituent parts of milk, from which we make our butter and cheese, or how to make the best of butter and cheese and to get the greatest returns or profits from our milk? "Let us reason together," as St. Paul says, and bring out and exchange ideas one with another.

Of what does one hundred pounds of butter consist? I will tell you as I understand it, viz.: Take say seventy-eight

pounds of pure oil of milk (butyric acid), put it in a vessel, a common cheese-tub (the oil taken from milk in June when the milk is rich in oil), and stir it well some fifteen or twenty minutes, then weigh it; you will have one hundred pounds of the best butter you ever saw. "But," says one, "where does the other twenty-two pounds come from?" It is oxygen (the oil of milk has a great affinity for oxygen) taken from the atmosphere; and here let us note an important fact in order to have good butter. The oil of milk, or cream, and milk itself, not only absorb oxygen, but several other gases which are more or less noxious; therefore we can see the necessity of having our milk-rooms as free as possible from all noxious gases.

Therefore, about seventy-eight pounds of oil of milk and twenty-two of oxygen will make one hundred pounds of the best butter that has yet been made. What is the difference between June and winter butter? It is this, viz.: While our June butter has from fifteen to nineteen per cent. of oxygen in it, winter has only from five to twelve per cent. of oxygen, the oil from winter milk being so poor it will not take in more, not much better than lard.

How can we always have good butter? First, healthy cows, cream taken from the milk within twenty-four hours after milking, churned while sweet, butter washed in cold water (with paddles, not with hands) until the buttermilk is out, which will be when it does not color the water, not before; salt to suit, put into air-tight tubs or cans, and your butter will be as sweet and as good in one, two or three years as when first made.

Or a better way is to churn the milk as soon as it is cold enough, say sixty to sixty-five degrees. Try it, one and all, and you will always have good butter.

In making butter and cheese we use but two properties that are in milk, viz.: Butyric acid or oil of milk, that property in milk which we use in making butter, and caseine or curd, that part of milk which coagulates when rennet is put into it.

Now I think, yea, am well satisfied, that I have made a very important discovery in relation to milk, viz.: That the butyric acid or oil of milk, from which all of our butter is

made, never was and never can be made or turned into cheese, not one particle of it; and that the caseine of milk, from which all of our cheese is made, never was and never can be made or turned into butter, and that I have made from milk within three hours after it was milked, butter and cheese, as much butter and as much cheese (lacking a few ounces) as though I had made but one kind—as good butter and as good new-milk cheese as the best.

I am well aware that the above statements will startle all of the butter-makers and cheese-mongers, and that the first question they will ask is this, viz.: If what you say is true, why is not skim-cheese as good as new-milk? Answer: The oil of milk and caseine are of less specific gravity than water, and when you skim milk the best of the caseine will be taken off with the oil of the milk, and is called cream. In June, when milk is rich in caseine and oil, four pounds of *butter-milk* will make a pound of cheese. Now, if any of the caseine or cheesy matter that was in the cream before churning, was turned or changed into butter, why not all? Rennet put into milk or cream coagulates or turns all the caseine to cheese, but not one particle of the oil (butyric acid) is changed or turned to cheese.

If any of the oil of milk is turned to cheese or curd, why, if done nice, can we get very near as much butter from the whey as we could from the milk before making cheese, as whoever will try can satisfy themselves that they can? After making your cheese, press out all the whey, wash the curd with cold water in order to get out the oil of milk, put the water into the whey, set the whey as you would milk, take off the cream, churn it when sweet, and you will find that you can get very near as much butter as you would had you not made cheese, and as good butter, providing you wash the butter well in order to get out all of the rennet. Be careful not to heat the milk above the natural heat, as it was when drawn from the cow.

There is nothing in the whole mineral, vegetable or animal kingdom, that man can take into his stomach, that is so well calculated to promote health as good new milk, good butter and good cheese.

Our physicians order barrels of cod-liver oil (from a lower

order of animal) for their patients. Now, I am firmly convinced that milk warm from the cow, or cream, better still, the oil of milk, is far superior.

Let the most confirmed dyspeptic take for supper stale bread well buttered, a small piece of cheese (butter and cheese made as it should be, made within twelve hours after milking), a cup of new milk (instead of tea or coffee), go to bed, and he will sleep as sweetly as a healthy babe on its mother's breast.

JOHN HILL, *Chairman.*

From the Report of the Committee.

CHEESE.—We believe the flavoring of cheese with sage or other condiments might be encouraged with profit to the producer and be appreciated by the consumer; but whenever the curd is to be flavored, the maker should be sure that his milk is in a perfect state. A soft strong cheese is only more unpalatable by the presence of foreign matter.

The factory cheeses were well "bored" by your committee, and we noticed they were by some others afterwards. This was a cruel wrong to the poor cheese which had suffered sufficiently by a hungry committee. We filled up the holes we made; some who followed took the whole plug. But here we found such slight variation in taste and texture that we were unable to fully agree. At this point we recognized not far from us Hon. Oliver Warner, secretary of state, whose previous acquaintance with some of the cheese brought to the Worcester West show would seem to make him an umpire of "distinguished" ability, and his services were solicited and cheerfully given.

We might stop here and say that the duties of the hour were gladly ended in the thankless task of awarding praise to some and less merit to other specimens of the dairy product. If we could tell all the good dairy-women and factory-men why some of their cheese is rich and mild, elastically soft and meaty, while others are spongy, salvy, sharp, strong, hard or dry, we would gladly do so; but some of the elements of success and failure ought to be named in this connection with reference to a product which in value exceeds all other agricultural productions in this vicinity, even if we repeat some suggestions we have made elsewhere.

The use of salt is generally well understood, but we occasionally hear the complaint that too much salt is used, which may be true. But the maker says, "Only so much salt is used every day to so many pounds of milk!" This may be true and yet too much be used. It is said that salt varies in strength.

In a communication from Prof. Goessmann of the Massachusetts Agricultural College, the highest authority, perhaps, in the United States in saline matters, he says that "the main difference regarding the better qualities of the various brands of dairy salt in our markets consists in the varying weight of an equal bulk. A well-kept dairy salt must be dry and of no particular odor; the latter has nothing to do with the strength of the salt. Those kinds which are made by the boiling, or boiling and washing process, are lighter, consequently more bulky, than those manufactured from the heavier coarse salt, obtained by the slow process of solar evaporation. A consequence of these facts is therefore the rule, 'Apply dairy salt by weight and not by measure.'" The above may be of value, but the cause of the trouble of which we have been speaking lies in another direction.

During the warm weather, when the thermometer is at eighty or ninety degrees, or when we have a humid atmosphere charged with electricity, or for the want of sweet utensils,—when other or any of those unfortunate phenomena exist, either avoidable or unavoidable, and your milk has begun rapidly to acidulate before it is placed in the hands of the cheese-maker, it must then be manipulated very rapidly in order to make anything passably good from it, and at the best he will do well if he makes nine-tenths as much cheese as he would from good milk. Here is a loss of one-tenth, to say the least, in curd, and it is difficult to tell the exact loss. The curd is salted according to the rule for sweet milk; consequently there is one-tenth too much salt in the cheese, unless the manufacturer has learned to discriminate very closely. The loss of curd by poor milk, to say nothing of the quality of the cheese, would go far towards paying a large factory-bill.

I believe that little need be said in this connection as to the importance of good feed, and what is of equal importance,

good water, both in the barn and field, to produce good, pure milk, and yet we are apt sometimes to overlook obvious facts. It would be well not to forget our experience in the fall of 1870, and, to some extent, that of 1871, when our cattle were compelled to subsist to a greater or less extent on a poor herbage and obliged to quench their thirst from some distant spring or some low and muddy spot or stagnant pool, when the milk during the process of coagulation, and more particularly in the process of cooking the curd at a temperature of ninety-eight degrees, disclosed the noxious impurities imbibed with bad water and taken in with poor herbage, which made their unmistakable appearance in the vapor that arose from the heated whey and curd. Impurities in the air may be inhaled into the lungs of the cow and conveyed from the lungs to the blood through the air-cells and by the glands from the blood to the milk.

Cleanliness in milking and a thorough cleaning of all milk-utensils are subjects which have always occupied our attention and have always been considered of vital importance, yet there are some whose milk is odoriferous, and there are some whose milk makes the whole vat too acid to make good cheese. Right here arises an evil of the greatest magnitude to the maker. How can it be prevented? The more animal matter enters into the milk the sooner fermentation and decomposition takes place.

If from any cause the cow has become unusually excited, the blood of the cow is not purified by the air in the lungs, and consequently becomes loaded with impurities which are taken up more or less by the secretory glands and find their way into the milk to perform their unfortunate mission.

"Thorough cleansing and scalding of all milk-utensils" is a maxim that should be repeated night and morning; a little leaven affects the whole mass in time. The active principle of ferment must be *destroyed*. This cannot be done effectually with water moderately hot; it should be at a temperature of two hundred and twelve degrees, boiling-heat. But after all the care and nicety in this regard, the milk does not always retain its purity and sweetness.

The practice of stirring the evening's milk is undoubtedly of great advantage, but a still greater one is claimed by more

completely introducing air into the whole mass, and by this means eliminating and throwing off more impurities and animal matter by means of the oxygen introduced. The custom of aerating the milk when kept in quantities of 200 or 300 lbs. by means of an air-pump has been practised, it is said, with highly satisfactory results, and the milk so treated not only keeps better and makes more cheese by one-tenth, but a superior article also. From our own observation we are led to believe that the statement is not far from the truth.

Rennets.—Much has been said about rennets, and it is worthy of remark that a decided improvement has been made in their preparation. The active principle of the rennet to produce coagulation is what we want in its perfect state,—nothing more, nothing less. This active principle lies on and is imbedded in the mucous membrane of the stomach, which we call rennet. All that we want of the rennet-skin is to hold these minute particles of coagulating matter in reserve until they are needed, soaked and thereby separated from the membrane and skin. If we could by any means separate this inner coating and by any process thereby preserve only what we want, much trouble would be avoided. In our present knowledge of the matter the only correct rule to follow is to remove every particle of the rennet except the bare skin to which the mucous membrane is attached, including the entire neck, which is generally loaded with fat and has but little membrane. It is a matter of high importance that we prevent any dried fat or fleshy substance in which decomposition has taken place from finding its way into the milk-vat, then into the cheese, where in the course of time its hidden power for harm makes its appearance.

Our experience teaches us that too much rennet may be used; if so, the cheese will cure rapidly, be soft and salvy, and consequently decompose early. So, also, if not enough is used to permeate the whole mass rapidly, the cheese will be hard and may present something the appearance of skim-milk cheese.

I am satisfied that at the present time there is no way for the Massachusetts cheese-maker to compete with the Western producer but by making a cheese of a higher standard of excellence. Can this be done? And what is the standard of

24

excellence in cheese? I answer, that the grass upon our hills and in our valleys cannot be surpassed by the coarse and more luxuriant grass on the plains of the West in giving that mild, rich and agreeable taste which we all admire. The other great substantial element of life, pure water, can nowhere be found in greater perfection than in the soft, pure water from the ten thousand springs that gush from our hillsides on every hand.

Water is more the life of animal existence than solid food, and our soft water has its decided advantages over the water of the sluggish creeks and hard-water wells in the clay-lime subsoil of the West in producing milk of the highest quality.

Again, we live nearer the markets, and moreover have a home-market only a few hours distant, while theirs must be on the road from one to two weeks, and when shipped for Europe, as most of it is, must be in the boxes three or four weeks. Cheese confined from a free, pure atmosphere and a moderate degree of sunlight cannot mature to that perfection which it will when these conditions exist.

There is much difference in opinion as to what a good cheese should be in all respects; and the question arises, What is the standard of excellence in cheese? In answer we can simply give our own opinion. It should be so mild to the taste as to leave none in the mouth, so delicate in texture that it dissolves with but little mastication and yet leaves no sticky impression on the palate, and when pressed between the thumb and finger have a slightly elastic touch, yielding but not salvy,—one that is so easily digested and inoffensive to the stomach that a dyspeptic, a delicate lady or child may eat of it with freedom, and yet is substantial food for the strong and stalwart man, upon which he may rely as much as on any other article of diet for power to his muscles and vitality to his system.

There has been a wonderful change, both in this country and in Europe, within the last fifteen years, in the taste for excellent cheese, and we believe that the greater the discrimination and the more general the appreciation of the intrinsic merits of this staple commodity, the greater will be the demand.

The question has arisen in our minds, To what extent shall

your society encourage this industry, which is the very life-blood of our prosperity, and what effort shall we make to stimulate to a higher excellence and more extensive production?

You offer a premium of thirty dollars for the best-managed farm, the income of which may be $500 or $1,500. Eight dollars is offered for the best specimen of cheese made at a factory where perhaps more than $150,000 worth of milk is converted into a commodity, the income of which vitally affects fifty farms. We suggest a greater stimulus in a higher premium, and a wider field of observation, by requiring a committee to visit the different factories and inspect the management and the quality of the cheese in its different stages and carefully compare merits and defects, thereby gaining much valuable information for the good of the whole dairying community. It is not a difficult thing to select one or two cheeses of the finest quality from either of the factories in Hardwick, New Braintree, Barre or elsewhere. These may be exceptions; the point to be gained is to have all of a uniformly high standard. The cheese of Worcester County has to-day a higher reputation in this regard than any other section, and yet it is too low.

But we leave it to the wisdom of your officers whether they cannot make a "new departure" which shall enhance the production of an article of sustenance which has increased in favor and utility ever since it was first made in the once fertile valleys and on the green hillsides of ancient Judea, and which will continue to be more and more prized as a necessity for man's daily food.

T. P. Root, *for the Committee.*

NORFOLK.

Statement of A. W. Cheever.

Butter.—The package of butter herewith presented is a sample of six hundred and ninety-seven pounds sold during the past four months, from an average of eight cows. The largest number milked during the time of trial was ten. Two have been sold for beef. Four calved since the commencement of the trial, and two of these calves were fattened and three others have been raised on new milk for about two weeks, and then fed with milk twelve hours' old for some

three weeks longer. One of these calves was dropped just before the commencement of the trial.

The two cows sold were twelve years old. All the others were less than five at the commencement of trial. One is now five years old; two are four years; two are three years, and two are two years, and the other twenty-one months at the time of calving, which was July 15th. The two three years old calved last year, and will come in again next winter.

The average yield per week has been about four or five pounds per cow, which would be a small quantity if the animals had been of full age and were in full flow. My average for the past two years has been over two hundred pounds per cow, of butter sold, besides selling nearly one day's milk per week. During the trial, one day's milk has been sold each week, one half of which stood twelve hours before skimming, the other half sold new; and besides what milk, butter and cream has been used in my family, one quart of new milk has been sold every morning.

The feed has been good pasture about four weeks, green rye, green cornstalks, and the best of hay fed in the stalls the remainder of the time. Some grain is fed every day—to beef-cows all they will eat, and to the others enough to keep them in good working condition. The grain has been about equal quantities of corn-meal, cotton-seed meal and wheat-bran, varying from four to eight quarts, according to the age and condition of the different animals.

My milk is kept above ground, in tin pans, set on racks; my room is well protected from the sun on the south by a covered and blinded walk, and by trees and vines. The north window is protected by blinds, the sash being entirely removed most of the time. I give my room a very thorough airing in the night, but keep it pretty close during the day. In that way I have kept my weekly supply of butter very even; one week only, and that in August, did it fall off very perceptibly. Have churned twice a week most of the time. Always wash the butter in cold water as soon and as clean as possible after churning, to remove all the milk. While washing work it dry, then salt with less than a half ounce of salt per pound. Let it stand, or rather *hang* in a cool well a few hours, then work over and put up for market in pound lumps,

or one-quarter pound cakes. The price obtained is fifty-five cents by the year, and during the summer forty pounds per week are engaged, and thirty pounds per week in the winter.

The butter is never touched with the hands; it is sometimes salted in the churn, but always worked under a lever on a hardwood table, set so inclined as to allow the milk and brine to run off freely. Temperature at churning from sixty-two to sixty-four degrees.

A. W. CHEEVER.

SHELDONVILLE, Sept. 12, 1872.

TRANSPLANTING FOREST-TREES.

PLYMOUTH.

Statement of Messrs. Ames.

The lot of transplanted white-pines we enter for premium contains about six acres, upon which we set young pines in 1853 and 1854 in April and May of each year, which we think is the best time for transplanting evergreens. The trees were taken from open ground, where they had been exposed to the sun and wind, such trees being more hardy than those growing in shady and sheltered places. They were from one to four feet in height, and were mostly taken up with a spade or shovel, not pulled up, as pulling is apt to strip the bark from the roots. They were set about eight feet apart, and have done very well, being from twenty to thirty feet in height and six to ten inches in diameter. The soil varies from light and sandy, on the higher and larger portion of the lot, to gravelly and dark loam as it approaches the low land adjoining.

Statement of Zebulon Pratt.

As I do not know the form of report requisite, I will give you the facts in regard to the way in which I transplanted the white-pine trees I have entered for premium. I purchased twenty-five acres of land, soil thin and worn-out, for two hundred and twenty dollars. I paid six dollars per acre to have the trees set out, in rows ten feet apart each way. The trees were from six inches to two feet high, and were dug from pastures and the sides of the highway, a portion of them

being purchased at a cost of about ten dollars. They were taken up with a sod about one foot square, or the width of a shovel-plate on each side. When set, a line about ten rods in length was stretched, having white strings tied ten feet apart. A sod was then taken out under each string, and a sod with a tree attached placed in the hole and pressed lightly with the foot. The trees were set in 1856. During the next two years I paid forty dollars to have the trees that died replaced, so that there should be no vacancies. The trees are now from fifteen to twenty-five feet high, and from six to fourteen inches in diameter.

As will be seen by these statements, Mr. Pratt has a much larger area in transplanted trees than the Messrs. Ames, and his trees, although not as old nor as tall as theirs, are more stocky and quite as likely, in the end, to make valuable timber. But he fails to meet that condition of the offer which requires five hundred trees per acre. To secure this number, in rectangular rows, they must not exceed nine feet and four inches apart, while his are ten feet; and for this reason the first premium is awarded to the Messrs. Ames, whose trees are eight feet apart only, giving, if there were no vacancies, six hundred and eighty trees per acre. As Mr. Pratt has so successfully planted a forest, on so large an area, it is recommended that the second premium be paid to him, notwithstanding his preclusion by a strict construction of the terms of the offer.

The wisdom of requiring five hundred trees per acre is at least questionable. The value of white-pine timber consists mainly in its softness and lightness, and its consequent superiority for many of the uses to which sawed lumber is applied; and that arrangement of trees in the forest which will secure the most sawing timber in the shortest time, is the most desirable one. White-pine trees worth, standing, ten dollars each, and even more, are occasionally met with, while such as are worth five dollars are quite common; but where, in our county, can there be found, on one acre, five hundred trees worth ten, or five, or even two dollars each? It is true that in native forests, and under favorable conditions, ten thousand trees may, and often do start on an acre, but long

before they become of any value, ninety per cent. of them will disappear, and seventy-five per cent. of the remainder will but struggle on for a time, in the fruitless attempt to maintain an existence against the encroachments of their more vigorous competitors.

What advantage can it be to draw upon the soil for the support of trees which are not expected to become mature? A good farmer, intending to raise one hundred turnips or cabbages on a given area, would not start five hundred plants, and wait for four hundred of them to die of suffocation or starvation. Every plant, in excess of the required number, would be a mere cultivated weed, all the more noxious because it would take from the soil precisely the same elements which are necessary to the growth and perfection of the proposed crop. Why is not this proposition as true of trees as of turnips or cabbages? One tree to each square rod, or one hundred and sixty per acre, is quite as large a number as can be expected to grow, rapidly and evenly, to a size suitable for good sawing timber. Twice that number, or three hundred and twenty per acre, would be sufficient to prevent the necessity for re-setting any single trees, lost through accident or otherwise.

The only plausible reason that can be urged in favor of cumbering the ground with supernumerary trees is, that the growth of limbs will be thereby prevented, and the trunks kept smooth and clean. But vigorous limbs are absolutely essential to the rapid and healthy growth of trees, a scarcity of limbs necessarily resulting in deficiency of foliage. When they have performed their appropriate functions, nature will remove them just as surely as she will underling and useless trees; with this advantage in favor of the limbs, that while they remain, they will promote the growth of the timber instead of hindering it. With only three hundred trees per acre the lower branches would all disappear long before the trunks would attain a diameter of two feet.

Pine lumber, in some of its almost innumerable forms, has become almost indispensable to the success of nearly every industrial pursuit. The primitive growth of timber on our northern borders from which such lumber has been chiefly manufactured, and which has been deemed almost inexhausti-

ble, is disappearing with a rapidity and certainty which ought to startle the community into the adoption of some persistent and systematic action for securing a supply for the future, or for the invention of a substitute. Making every suitable allowance for erroneous computations, the products of these forests must diminish sensibly during the next decade, and, in all probability fail utterly during the succeeding one. When this result is reached, whether sooner or later, and our lumber-markets become dependent upon local supplies, white-pine woodland will be more desirable property than the stocks and bonds, now so popular as investments, and so universally worshipped by the devotees of Mammon.

Young white pines have been inconsiderately destroyed on many an acre of land, which, had they been allowed to remain, would now have been worth ten times its present value and all the income derived from it since their destruction. It is not desirable, of course, to have our fields disfigured by occasional scraggy seedlings, injuring them for pasturage, and not changing them to forests. But there are portions of nearly every farm where a growth of forest-trees would be more valuable than the scanty innutritious herbage they reluctantly yield. To such places every seedling white-pine which makes its appearance where it is not wanted, or where it would be destroyed, should be carefully removed and set at a suitable distance from others which may have preceded it. This course pursued for a few years, would secure, without appreciable cost, a very satisfactory addition to the cash value of the land, and furnish its owner a most worthy source of pride and pleasure.

The greatest hindrance to the perfect growth of white-pine timber is the grub or borer, which is hatched from an egg deposited by the turpentine fly, and which seems to prefer the partly-grown leading-shoot, in the central part of which it burrows, leaving a thin shell on the outside through which sufficient sap will ascend to maintain the semblance of life, until the insect, having completed its existence as a grub, makes its exit, seeking the ground as its abiding-place during its next or chrysalis state. Later in the season the shoot dies, and nature, in the exercise of its wonderful recuperative powers, forces one of the lateral shoots to assume the

office of a leader, by which the growth of the season is preserved, at the expense of the comeliness of the tree. The subsequent yearly accretions of wood will be in a direction tending to bring the trunk into symmetrical form, but perfect symmetry will never be reached. The formation of wood may proceed quite as rapidly after as before the injury, but the value of the timber will be lessened, especially if, as sometimes happens, similar injuries follow in succeeding years.

These insects are more plentiful and destructive on warm, sandy soils than on low and colder ones. In wet swamps they are seldom found, and, consequently, trees growing in such places are more symmetrical and taller than those of the same diameter growing upon uplands. In selecting a location for a pine forest, low land should be preferred, for this, and probably for other reasons.

ALDEN S. BRADFORD, *Supervisor.*

INSECT-EATING BIRDS.

MIDDLESEX NORTH.

Prize Essay by Frank H. Palmer, Boxford.

[The following Essay was presented at the fair of the Middlesex North Agricultural Society and received the first prize of fifty dollars offered by the Massachusetts Society for the Prevention of Cruelty to Animals.]

The practical utility of our native birds as agents for the destruction of noxious insects can hardly be overestimated. By studying the habits of birds and insects we may easily discover the important part which each plays in the economy of nature, and history itself proves that any material interference with their relations to each other is sure to be followed by disastrous results. Hence the subject becomes of deepest importance not alone to the agriculturist but to every one who has either a business or patriotic interest in our country. Nature, if left to herself, establishes a wholesome balance amongst her creatures; that is,

Fig. 1.—Sparrow-hawk. *Tinnunculus Sparverius.* (Raptores.)

she produces no more of one species than shall be kept in check by another. If there is an insect which feeds upon a certain plant, there is also a bird which destroys the insect and an animal which devours the bird; and so on up the scale, each curbing the undue increase of the next inferior creature. It is when man interferes with the working of this law that results are sure to follow disastrous alike to his own food, health and happiness and that of the creatures around him. It is because he has destroyed their natural enemies that insects have become a pest, and they will cease to trouble him only in proportion as he shall restore the balance of which nature shows the necessity. It is not that insects are to be destroyed or condemned as a class. Nothing is created except for the fulfilment of some good end, and the value of insects is not inferior to that of any other class of animal life; none are without their legitimate uses, and it is only when they are stimulated to excessive increase that they become troublesome. Before passing judgment upon them we must remember that insects fabricate the beautiful coral which is so useful and valuable to man. Of similar origin, too, is silk, which, in its manufacture, furnishes profitable employment to multitudes of men,

Fig. 2.—Mottled or Screech Owl. *Scops-asio.* (Raptores.)

Fig. 3.—Hawk-owl. *Surnia ulula.* (Raptores.)

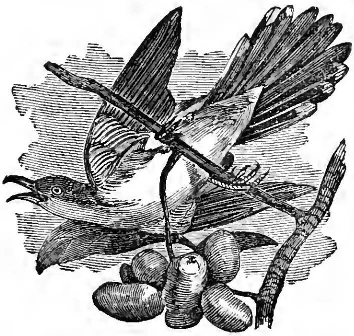

Fig 4.—Black-billed Cuckoo. *C. erythrophthalmus.* (Scansores.)

women and children, and brings in large revenues to the country. Insects we must thank for honey,—the sweetest of sweets. The air we breathe and the water we drink are kept pure and wholesome by the agency of myriads of little creatures which draw sustenance from the impurities of the elements. It is not, then, that insects are to be exterminated, even if it were possible, but only kept in check.

RELATIVE FERTILITY OF BIRDS AND INSECTS.


Fig. 5.—Upper fig. Wood-Pewee. *Contopus virens.* Lower fig. Kingbird. *T. carolinensis.* (Insessores.)

The majority of our native birds have but one brood of young in the course of the year, a few have two or three. In the case of the smaller insect-eating birds the number of eggs to a brood is on an average not more than five. Some of the larger birds, as the various Gallinæ, lay from five or six to twenty eggs to a brood. On the other hand the reproductive energy of insects is truly marvellous. It is said that a single pair of grain-weevils have produced six thousand young between April and August. The common varieties of aphides

or plant-lice which are found on almost all kinds of plants are produced in spring from eggs laid the season before, and through the summer only females are developed. At the last of the season males and females both appear, and eggs are laid for the brood which hatches early in the spring. Reaumer says that one individual in one season may become the progenitor of six thousand millions.

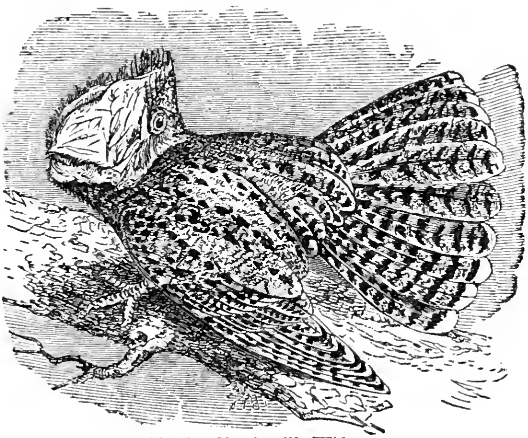

Fig. 6.—Chuck-wills Widow.

The silk-worm moth produces about five hundred eggs; the great goat-moth about one thousand; the tiger-moth one thousand six hundred; the female wasp at least thirty thousand. There is a species of white ants, one of which deposits not less than sixty eggs a minute, giving three thou sand six hundred in an hour. How then shall this enormous mass of insects be kept in check? What shall prevent them from overrunning the country, destroying the crops and devastating the land?

FOOD OF BIRDS.

Various causes operate to check the undue increase of insects, and the chief of these is the appetite and instinct, which a wise Providence has given to birds. If the number of eggs produced by insects is wonderful, the number destroyed by a single bird is no less so. Audubon says a woodcock will eat its own weight of insects in a single night. Dr. Bradley says that a pair of sparrows will destroy three thousand three hundred and sixty caterpillars in a

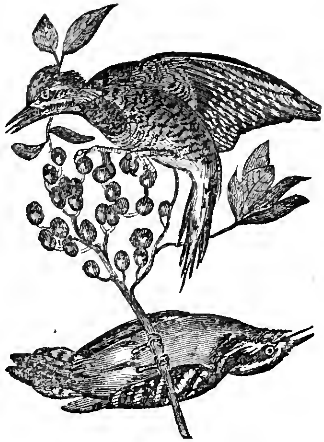

Fig. 7.—Woodpeckers.

week. We saw the parent bird visit a young purple martin on a church-spire opposite our window five times in as many minutes, each time with an insect. A brood of partridges will nearly exterminate the denizens of an ant-hill in a couple of days. Woodpeckers are constantly employed in ridding the orchards of insects and their eggs, which they skilfully discover under the pieces of dead bark. Robins, through the spring and summer, are continually hunting for worms and grubs which they find concealed under the surface of the ground. We recently noticed a common chipping-sparrow capture a moth, and upon depriving her o it we found it to be that of the common apple-tree caterpillar (Clisiocampa Americana) so destructive to the orchards of New England. To check the excessive increase of insects is evidently the great task which birds are intended to perform. Did they have no other office save to cheer and encourage humanity with their beautiful plumage and song, and to typify a purer and more ethereal existence to us creatures who "grovel here below," even then they would deserve the favor of every Christian and every poet. But when the useful is combined with the beautiful, and a practical value is added to an elevating symbol, they command the interest of every one, and their protection becomes a matter of consequence to all.

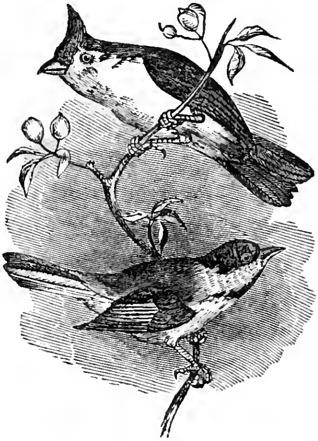

Fig. 8.—Titmice.

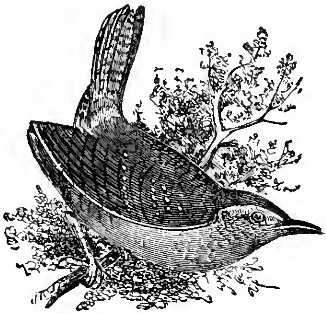

Fig. 9.—House-wren. *T. ædon.*

DECREASE IN NUMBER OF BIRDS.

It is a mournful fact of history that during the past few years there has been a steady decrease in the number of our native birds in all parts of the country where man has formed his settlements. To account for this fact is easy. Man enters the forests which for hundreds of years have been the undis-

turbed nursery of birds. He cuts down the trees in which for centuries they have reared their young. He brings with him his gun, and as long as there are any grouse or other game-birds in the neighborhood, the sharp report and murderous fire are his daily greeting to the wild creatures of the wood. He dams the streams and turns them aside and uses their power to destroy the forests on their banks. His snares are set in the valley and his traps on the hill-top. His children search the woods for birds'-eggs and bring them home to be admired a moment as playthings without a thought of the happy homes they have destroyed for the sake of a moment's pleasure. In short, man has soon taught the creatures, who scarcely feared him at first, that he is a monster to be dreaded, who will give them no rest nor peace. Thus it happens, that as the centuries roll on, one species after another grows more and more scarce, or becomes altogether extinct, and in their loss the world loses more than at the death of the last representative of a long line of imperial princes. Let us notice from history a few instances of the gradual decrease of some of our birds, that any who are doubting may be convinced. Hear what Audubon testifies : "When I first removed to Kentucky, the pinnated grouse were so plenty that they were held in no higher estimation as food than the most common flesh, and no hunter of Kentucky deigned to shoot them. In those days, during the winter the grouse would enter the farm-yard and feed with the poultry, alight on the houses, or walk in the very streets of the villages. I recollect having caught some in a stable at Henderson where they had followed some wild turkeys. In the course of the same winter a friend of mine who was fond

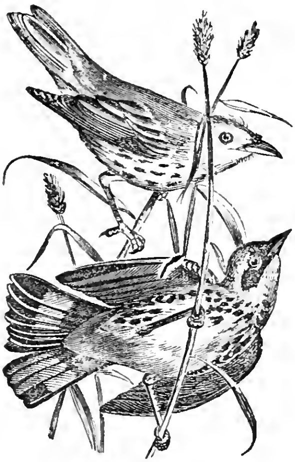
Fig. 10.—Upper fig. Yellow Warbler. Lower fig. Black and Yellow Warbler.

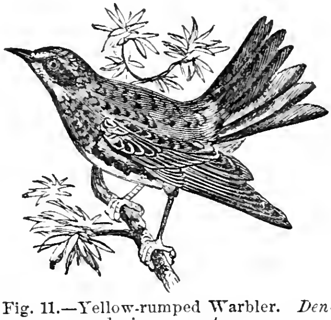
Fig. 11.—Yellow-rumped Warbler. *Dendroica coronata.*

of practising rifle-shooting killed upwards of forty in one morning, but picked up none of them, so satiated with grouse was he as well as every member of his family. My own servants preferred the fattest flitch of bacon to their flesh, and not unfrequently laid them aside as unfit for food." Twenty-five years after the same author says, "Such an account may appear strange, but in that same country where, twenty-five years ago, they could not have been sold for more than one cent apiece, scarcely one is now to be found. The grouse have abandoned the State of Kentucky and removed (like the Indian) every season further to the westward to escape from the murderous white man." The bird above mentioned was once probably very abundant in all the southern New England States, but is now only found in small numbers on Martha's Vineyard and one or two other islands off the southern coast of Massachusetts, being entirely extinct on the main land of New England.

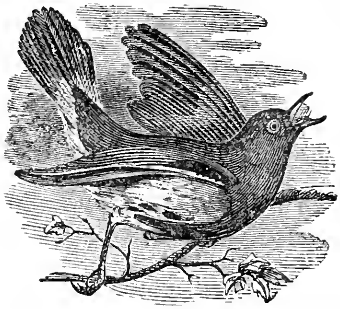

Fig. 12.—Redstart. *Setophaga ruticilla.*

Mr. J. A. Allen says:* "The mammalian and bird faunæ of all the older settled parts of the United States are vastly different from what they were two hundred years ago. These changes consist mainly in the great decrease in number of all the larger species, not a few of which are already extirpated where they were formerly common. A few of the smaller species of both classes have doubtless increased in numbers. Many of our water-fowl that are now only transient visitors,—as the Canada goose, the several species of Merganser, teals, black duck and mallard,—undoubtedly once bred in this State (Massachusetts), as did also the wild turkey and prairie hen." An old farmer of Essex County recently told us that fifteen years ago the pas-

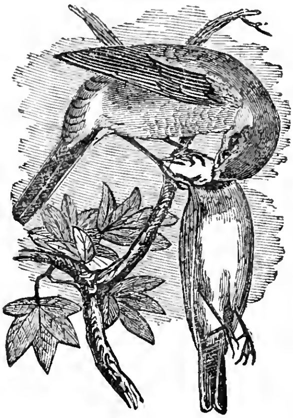

Fig. 13.—American Shrike. *C. borealis.*

* "American Naturalist," Vol. III., No. 10.

senger-pigeon was accustomed to breed in considerable numbers in a forest not far from his house. Now a few pairs may be seen in the spring and fall migrations, but none in the summer. In the same county ten years ago the ruffed grouse was quite abundant, but now it is rare that any are seen except in the deepest woods, and then only an occasional pair, most of them having been snared and sent to the Boston market, laws to the contrary notwithstanding. Formerly some six or seven species of sea-ducks bred among the islands of Massachusetts. Now none are to be found except the dusky-duck, and that in no great abundance.

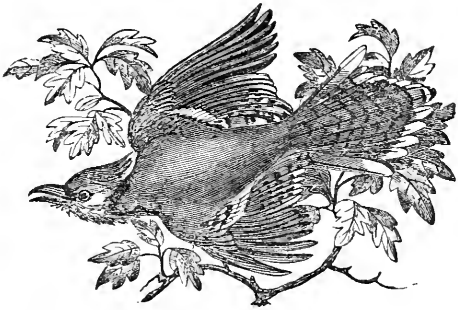

Fig. 14.—Blue-jay. *C. cristata.*

INCREASE OF INSECTS.

As a result of the decrease in the number of birds we find that insects have been steadily increasing, and the aggregate loss through their agency is now much greater than in former years. Since 1860 the damage done each year by such insects as the canker-worm, currant-worm, wheat-midge, Hessian-fly, &c., has been greater and greater, so that in some sections the cultivation of particular crops has been almost abandoned. New species of noxious insects are constantly being discovered by entomologists and others, while many species before unknown in this country have been introduced by the importation of plants, &c., from Europe. Insects that are abundant in the West are gradually working eastward, as the Colorado potato-beetle, and only earnest study and effort will prevent the continued increase of these pests of the land.

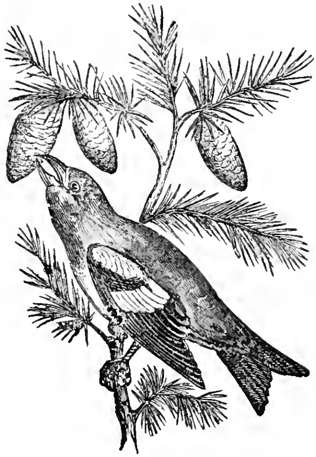

Fig. 15.—White-winged Crossbill.
Curvirostra leucoptera.

There are about thirty species of insects which subsist on our garden-vegetables. The grape-vine has about fifty insect-enemies; the apple-tree seventy-five; our different shade-trees some over a hundred; wheat and other grains fifty. The crop of wheat in the State of Illinois was injured by insects in one year to the estimated amount of seventy-three millions of dollars. The estimated annual destruction of property by insects in the United States is as high as four hundred million dollars. The effect of this loss is felt not alone by the farmer. It is to this in a large measure that many poor men owe their poverty; to this must be attributed the high price of farm-produce and all healthy food, and the consequent increase of disease and want in our large cities. We do not hesitate to say that at least one-eighth of this loss by insects might be prevented by the careful protection and encouragement of birds; or to put it in another way, the carelessness of the people of the United States in this respect costs them at least fifty million dollars yearly, beside much unhappiness and suffering.

Fig. 16.—Upper fig. Snow-bird. *Junco hyemalis.* Lower fig. Song-sparrow. *Melospiza melodia.*

HOW TO PROTECT BIRDS.

Of the measures for the protection of birds, perhaps the most important is the bird law of Massachusetts, a digest of which we append for convenient reference: Whoever takes, or kills, sells, buys or has in his possession between January 1 and August 15, any woodcock; between February 1 and September 1, any ruffed grouse or partridge; between April 1, 1869, and November 1, 1872, any quail or Virginia partridge; between March 1

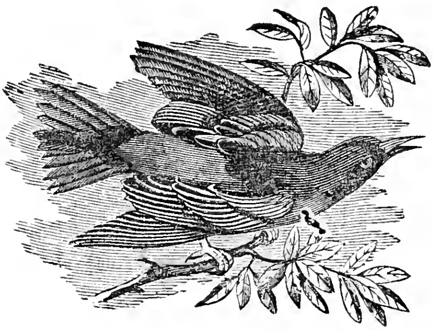

Fig. 17.—Baltimore Oriole. *Icterus Baltimore.*

and July 1, any marsh-birds or upland plover; between March 1 and September 1, any fresh-water fowl; and whoever after November 1, 1872, takes or kills any quail or Virginia partridge, except in the months of November and December annually, and whoever, at any season of the year within this State, takes or kills any of the birds called pinnated grouse or heath-hens, or sells, buys or has in his possession any of said birds so killed or taken; and whoever, at any season of the year within this State, kills any fresh-water fowl or sea-fowl, either on the feeding or roosting-grounds of said fowl, shooting from any vessel, boat or craft, or chases or pursues and captures said fowl upon or from their feeding or roosting-grounds in any boat or vessel of any kind whatever; and whoever at any season of the year takes or kills any undomesticated bird not heretofore mentioned in this act, except snipe, hawks, owls, crows, jays and gulls, or destroys or disturbs the nests or eggs of such undomesticated birds, except the nests and eggs of hawks, owls, crows, jays and gulls, without having first obtained from the mayor and aldermen of any city or selectmen of any town, a written consent to take or destroy for scientific purposes only, such birds and eggs as said written consent may specify, shall forfeit for every such offence twenty-five dollars. The mayor and aldermen and selectmen

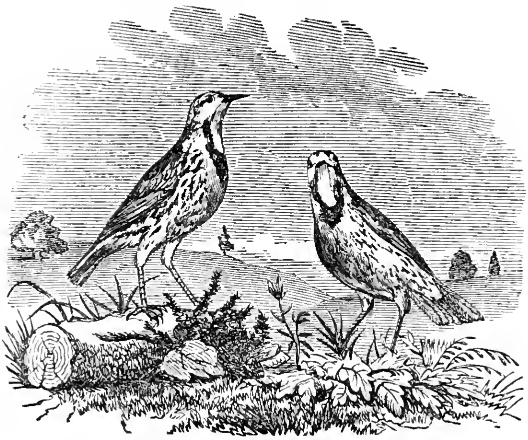

Fig. 18.—Meadow-lark. *Sturnella magna.*

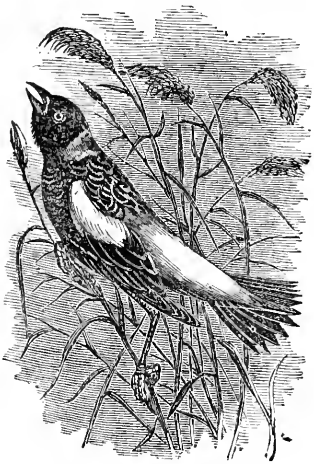

Fig. 19.—Bobolink. *Dolichronyx oryzivorus.*

of the several cities and towns of this Commonwealth shall cause the provisions of this law to be enforced in their respective places; and all forfeitures accruing under these sections shall be paid two-thirds to the informant or prosecutor and one-third to the city or town where the offence is committed.

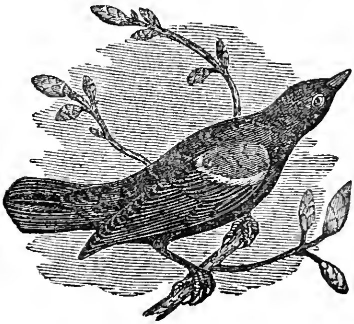

Fig. 20.—Red-winged Blackbird. *Agelaius phœniceus.*

In itself, perhaps, no fault can be found with this law. It is only because it is not properly executed that it falls short of accomplishing its object. In the neighborhood of the large cities it doubtless prevents some injury to birds, but in the small country towns we think it is very rarely that an arrest is made, and the selectmen are quite apt to look the other way to save the trouble of interfering with a neighbor or townsman. We have repeatedly seen strings of ruffed grouse, containing some dozens, which had been taken in abominable snares, being sent in to the Boston market from the small towns of Massachusetts. We believe it is still a common practice with many boys to make collections of birds'-eggs, and to take not one egg only, but the whole nest, eggs and all, and shoot the parent birds, too, if possible. It is difficult to say how such things may best be prevented, but much good would be done, we are confident, if the selectmen would take the trouble to hunt up and punish a few cases which should serve as an example to others. Parents and teachers also may do much by way of precept and example, and right-minded boys may do their part by influencing their companions to abandon so cruel a practice.

Fig. 21.—Raven. *Corvus carnivorous.*

Next to the law the most important measure for the protection of birds is the putting up of accommodations for them and

thus inducing them to settle on our estates. There is no reason why every one who has a half-acre of land should not have two or three pairs of birds nesting thereon. Perhaps many do not realize what simple accommodations swallows, bluebirds, wrens and other birds are eager to avail themselves of. Simple and inexpensive arrangements are just as satisfactory to them as the most elegant and costly ornamental houses, and no one need be prevented by the fear of expense from furnishing dwelling-places, rent free, to these interesting tenants. With a few simple tools and a box or two which any grocer will give you a bird-house may be made of almost any size or shape desired. Should you wish it highly ornamental, nothing is better than to cover it with rustic-work, which may be done with the aid of a wild grape-vine cut in pieces of the right length and nailed on. Such a bird-house costs little or nothing save the time required to make it, and this slight expense will be amply repaid by the satisfaction of doing a good deed.

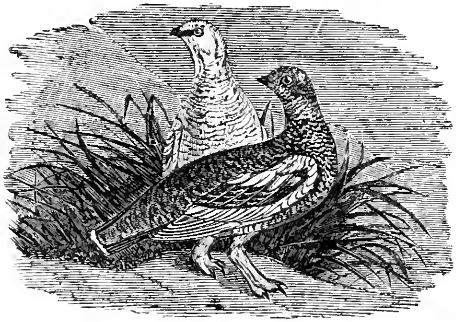

Fig. 22.—Ptarmigans.

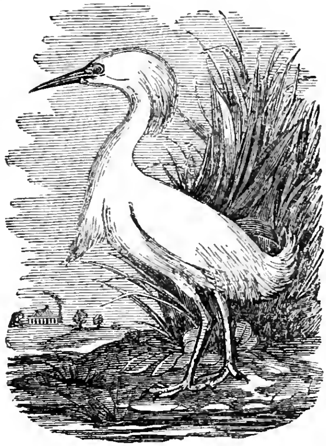

Fig. 23.—Snowy Heron. *Garzetta candidissima.* (Grallatores.)

There are many simple contrivances which may be prepared and put up in five minutes and will serve the birds as well as anything else. At the opening of the present season we put up four tin-cans, such as are used for canning tomatoes, having first filed a small hole in the lower end to prevent the collection of water. Three of the four were immediately occupied by bluebirds. One pair laid five eggs, four of which hatched and the young grew to maturity. The other two pairs each had two broods, four eggs to each brood, and all hatched, but three of the

young died before growing up. Seventeen young bluebirds and their parents, six in number, twenty-three insect-eating birds, were thus induced to make their home in our orchard, the parent birds for about five months and the young, say about three months. Certainly at a very low estimate each bird would average twenty insects a day, for the food of these birds consists entirely of insects. At this rate the old birds would have destroyed, during their stay here, eighteen thousand insects, and the young thirty thousand six hundred, which gives a total of forty-eight thousand six hundred insects destroyed from our own and our neighbors' trees, and it did not take us half an hour to prepare and put up these simple accommodations. Are not these facts eloquent?

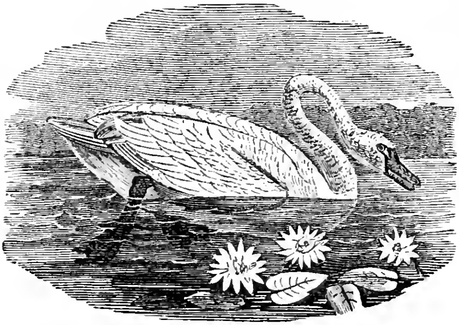

Fig. 24.—American Swan. *Cygnus Americanus.* (Natatores.)

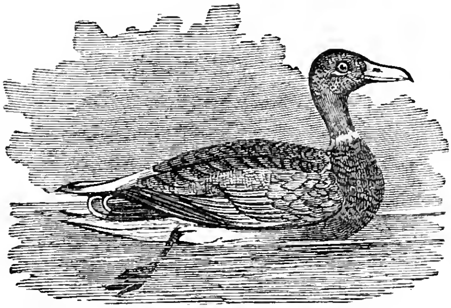

Fig. 25.—Mallard Duck. *Anas boschas.*

Then how interesting to watch the housekeeping arrangements of these beautiful little neighbors; to hear their welcome song when winter seemed still with us; to hear them debate the situation and finally decide in favor of our apple-tree; to see them carrying up grasses and cotton and feathers and weaving them together into a bed of down for the protection of their early-laid eggs; to watch their love-making and all their gentle, affectionate ways towards each

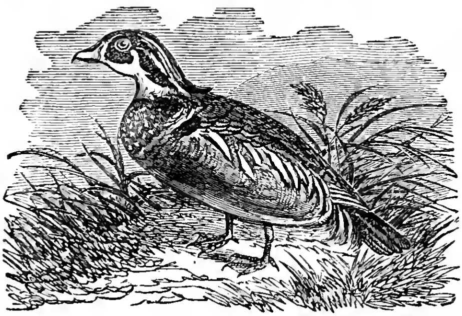

Fig. 26.—Wood, or Summer-duck. *Aix sponsa.*

other; their jealousy of intruders and their solicitous care of their eggs during the period of incubation; their final joy when the young break the shells and are born to the light, and their untiring devotion in obtaining choice bits of insect-food for the nourishment of their offspring. Truly here is Beauty at our dooryard and Poetry has taken up her abode in our apple-tree.

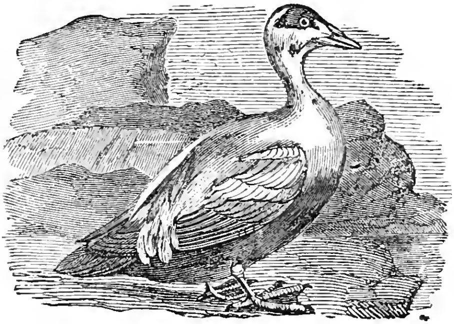

Fig. 27.—Eider-duck. *Somateria mollissima.*

Purple martins and other members of the swallow-tribe, will readily occupy boxes put up for their use. Wrens, too, are interesting friends, and are easily induced to settle with us. We knew of a case where a pair of bluebirds found a happy home in an old beaver hat which had blown up and lodged in an apple-tree. A good bird-house may be made of a medium-sized flower-pot, with the hole somewhat enlarged and the top covered with a board. Will not every one who has a dozen rods of land make a bird-house of some kind, and thus help restore the proper proportions of the feathered and insect races?

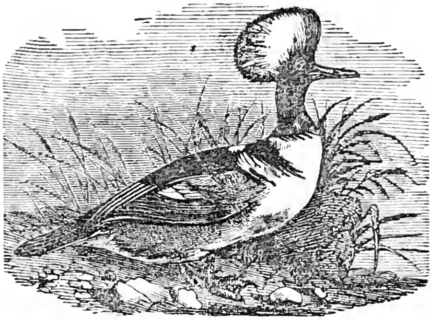

Fig. 28.—Hooded Merganser. *Lophodytes cucullatus.*

TABULAR VIEW OF FOOD OF BIRDS.

We must conclude, then, after careful examination of the habits of birds and insects, that birds are of the greatest service to man, and that they should be protected and encouraged in every possible way. Nevertheless, it is undeniable that this rule has some exceptions; that there are some birds which are far from beneficial, being on the contrary very injurious not only to the interests of man but also to the well-disposed members of their own race. In short, there are robbers and cut-

throats amongst birds as well as amongst men; and it is just as sensible to pronounce the human race good for nothing because of the depravity of a portion of its members as to say that birds are useless because a few species are inclined to wrong-doing. The following table will give an idea of the food of the more common birds of Massachusetts, and will serve as a ready means of distinguishing the injurious from the beneficial species:—

FAMILY.	ORDER—*Raptores* (Robbers).
Falconidæ, Hawks, . . .	Subsist on small birds and animals, and poultry.
Strigidæ, Owls, ...	Mice, reptiles, insects, and a few small birds.
	ORDER—*Scansores* (Climbers).
Cuculidæ, Cuckoos, . . .	Caterpillars and other tree-insects, and a few eggs of other birds.
Picidæ, Woodpeckers, . .	Insects (a very beneficial family).
	ORDER—*Insessores* (Perchers).
Trocilidæ, Humming-birds,	Insects.
Cypselidæ, Swifts, ...	All kinds of winged insects.
Caprimulgidæ, Whippoorwills and Night-hawks, .	Night-flying Lepidoptera (very beneficial).
Alcedinidæ, Kingfishers, . .	Fish.
Colopteridæ, Flycatchers, .	Flies and other winged insects.
Turdidæ, Thrushes, . . .	Insects and a few small fruits and berries.
Saxicolidæ, Bluebirds, . .	Insects.
Sylviidæ, Wood-inhabiters,	Insects.
Paridæ, Titmice and Nuthatchers, ...	Insects and their eggs.
Certhiiadæ, Creepers, . .	Insects.
Troglodytidæ, Wrens, . . .	Insects.
Sylvicolidæ, Warblers, . .	Insects and the seeds of weeds and grasses.
Hirundinidæ, Swallows, .	All kinds of winged insects
Bombycillidæ, Chatterers, .	Various insects and cherries.
Laniidæ, Vireos and Butcher-birds, ...	Insects and small birds respectively.
Fringillidæ, Seed-eaters, .	Various seeds, fruits and some insects.
Icteridæ, Starlings, Orioles and Blackbirds, . . .	Starlings and Blackbirds, grains and other seeds. Orioles, various tree-insects.
Corvidæ, Crows and Jays, .	Eggs and young of small birds, a few insects, corn and other grain.
	ORDER—*Rasores* (Scratchers).
Columbidæ, Doves, ...	Berries, nuts and seeds.
Tetraonidæ, Grouse, . . .	Various seeds, insects and berries.
Perdicidæ, Partridges, . .	Seeds, berries and a few insects.
	ORDER—*Grallatores* (Waders).
Ardeidæ, Herons, ...	Fish, frogs, mice and insects.
Charadridæ, Plovers, . .	Aquatic insects.
Scolopacidæ, Snipes, . . .	Worms, larvæ of insects, and grasshoppers.
Paludicolæ, Rails, ...	Various insects and water-worms.
	ORDER—*Natatores* (Swimmers).
Anatidæ, Ducks, ...	Small shell-fish and other aquatic animals.
Laridæ, Gulls, ...	Fish and various animals washed up by the sea.

We cannot close this paper without saying a word in regard to those two birds which have occasioned so much debate among farmers and others,—the crow and the robin. At one

time the agricultural papers were continually saying something for or against these birds, and although not so much is heard on the subject now, yet the question has not been settled to the satisfaction of all. From our own observation we are compelled to believe that the crow is a very injurious bird, but the robin an equally beneficial one. The crow is acknowledged, even by his friends, to pull up a good deal of corn, but it is urged that he destroys enough insects and grubs to compensate for this injury. Granting this, it leaves him neutral, doing as much good as harm; but this leaves unnoticed the fact that he destroys a great number of eggs and young of small birds which, if permitted to live, would have destroyed vastly more insects than the crow. The robin is blamed for eating cherries and other small fruits. This charge is doubtless just, but we must remember that it is not more than two months that he is injurious in this way, while during the other four months of his stay with us he must be regarded as beneficial.

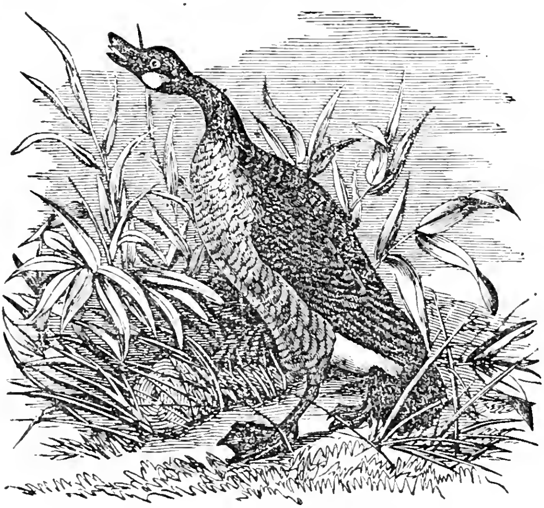

Fig. 29.—Wild-goose. *A. Canadensis.*

Fig. 30.—Wilson's Tern. *S. Wilsoni.*

Since the manuscript of this essay was prepared, the law protecting birds, given on pages 202 and 203, has been repealed and a new one enacted. Its provisions are, briefly, as follows :—

Woodcock are protected between the first day of January and the 15th day of August; ruffed grouse (commonly called partridges), between the 12th day of January and the 1st day of October; quails between the 15th of December and 15th of October. Forfeits, $25 for each bird above-named killed or sold out of season.

Pinnated grouse are protected till June 2d, 1876; wood or summer ducks, black ducks and teals protected between 1st of March and 1st of September. Forfeits, $25 for each bird killed or sold out of season.

Marsh and beach birds are protected between April 1st and July 15th; exceptions, snipe and plover. Forfeits, $10 for each bird.

All other birds, their nests and eggs (except crow blackbirds, crows, herons, bitterns, Canada geese and water-fowl not previously mentioned), are protected through the year. Forfeit, $10 for each offence.

INDEX

TO THE SECRETARY'S REPORT.

INDEX TO ABSTRACT.